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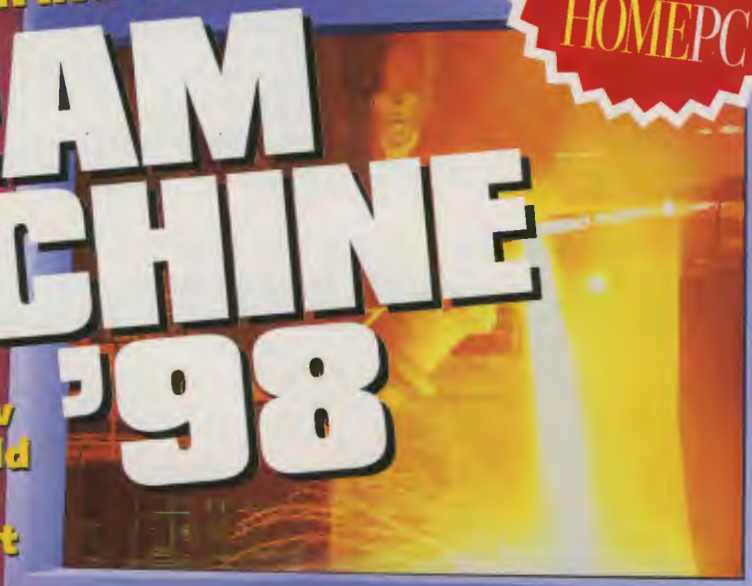

54 MAJOR RELEASES P/REVIEWED

INCLUDING:

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contents

▲ 58 Dream Machine 98
Picking only the best parts across 17 different component categories, we build the ultimate $5,000 PC. Whether you're building a computer from scratch or simply want to upgrade a single key part, don't make a move until you're fully armed with this year's Dream Machine buyer's guide.

▲ 78 CPU Roadmap 2000
We've seen the future, and it is fast. Here's the travel itinerary for all the processors that Intel, AMD, Cyrix, and IDT/Centaur plan on cranking out during the next year and a half. Giddy up!

50 Interrogation: S3's Terry Holdt ▶
S3's CEO doesn't have time to worry about the ViRGE chipset's limp performance—he's gearing up to evangelize S3's Second Coming. Meet Terry Holdt and his Savage3D accelerator. It might just be fast enough to erase S3's mistakes.

content

01

PC WATCHDOG, p.33

▶ VOICES

8 Ed Word **Big Daddy** introduces you to the whole undefinable Maximum PC gestalt. Hop on board—and bring your Phillips-head screwdriver.

11 Comm Port You send letters. We respond. Personally. With minimum BS. Can't take the heat? Then get out of the Comm Port.

17 Meet the Crew Your Personal PC Advisors are ready to serve. Scan our starting line-up, and choose your favorite player.

27 Fast Forward CPU guru **Tom Halfhill** explains his dream operating system—a VirtualOS that's immune to "system crashes, evil viruses, and monkey damage."

29 On the Line Internet ingenue **Shel Kimen** leads you through the kitsch-kinky world of online pom—and finds that sex leads technological advancement.

31 Game Theory Veteran computer gamer **T. Liam McDonald** says games don't have to be pretty to drop you into an immersive la-la land.

164 The Saint Industry troublemaker **Alex St. John** explains why *Quake*—that's right, *Quake*—is the only platform that has a shot at killing Windows.

miroVIDEO DV300, p.139

▶ NEWS

40 Inside Source Janet Reno leads the antitrust assault against Microsoft and Intel: Pundits sift through the carnage… DVD-RAM: Who's to blame for the slow road to retail?… Socket X: A handy new motherboard interface for pop-in graphics chips. Micron and Rendition built it, but will we come?

The Evolution of DVD-RAM, p.42

▶ TECH FILE

33 Watchdog Feeling ripped of manufacturer? The Watchdog investiga your complaint and exacts justice from who've wronged you.

77 Ask the Doctor Medical for all the PC ills that ail you. Ask away We *will* make your machine happy aga

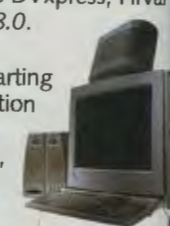
149 Terminator All our geek terms explained in plain English. Even P boys will learn a thing or two.

▶ PRODUCTS

21 Peripheral Vision The co high-tech gear to soup up your PC and lifestyle. If it comes in brushed steel or f black, you'll find it here.

86 Previews Early looks at cuttin edge hardware and software in develop S3 Savage3D, C-Cube DVxpress, HiVal RAM, and *Illustrator 8.0*.

94 Reviews Starting with an intense dissection of the first K6-2 machine to the hit lab, we present the most thorough, hands-on hardware and software reviews you'll ever read. Highlights include an i740 vid card roundup, a hyper-speed CD-ROM expose, an intense study of three PCI sou cards, and reviews of the most powerful design tools in the software universe.



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EDWORD

100% Pure PC Power

There's never been a magazine for experienced PC owners. In the past, you've had to wade through all the corporate mags, hoping for a few stray pages that might suit your needs, and then feverishly scan the daily newspapers and web sites for some tech tidbit.

But now there actually is a magazine just for you.

Welcome to Maximum PC, the only magazine/CD-ROM/web site/Internet radio show dedicated to the PC owner.

Month in and month out, we create the short list of the latest gotta-have gear for people that get off on tech. If it'll give you the edge, whether in the office or in the latest 3D fragfest, we're all over it. If it'll allow you to unleash your creative imagination in bold new ways, we've got you covered.

Remember: This magazine is all about you.

If you're into it, we'll cover it. No holds barred. We promise here and now to dedicate every page of every issue of Maximum PC to what you care about: Pure PC Power. And we guarantee you'll never see the stench of advertiser influence in these pages.

If it seems like we share your passion for Kick-Ass PCs, it's because we do. For us at Maximum PC, This ain't just a job—it's an adventure!

The Maximum PC editorial team has a long and well-earned reputation as some of the hardest critics in the industry, fighting nonstop to protect your interests as PC owners and getting in the face of anyone who would hype a half-ass product and try to pass it off as Kick Ass, our editor's choice award that goes only to the best-of-the-best.

To accomplish this, we do the most in-depth reviews you'll ever read. When it comes to systems, we open the case and test every component to the breaking point. We deliver benchmarks based on the type of tasks you use your machine for and we report metrics in units you understand—frames per second, time to render, MB/sec throughput—not some abstract numbers that mean nothing.

And every hardware test is performed by the reviewing editor, not some lab-coat lackey or flaky freelancer, so you can believe us when call 'em like we see 'em. And we aren't afraid to call bunk on the big boys when their big toys aren't up to snuff.

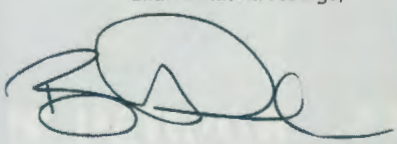
But it's not just about hardware. We'll also keep you up to speed on the software needed to fuel today's muscle machines, complete with step-by-step projects to expand your repertoire. From adrenaline-pumping games to apps that let you work smarter, from utilities that unleash the beast in your box to programs that flex your creative muscle, we've got it all lined up.

If all this sounds like we're on the same page as you, it's because it's true. We share your passion for the PC and all the amazing things you can do with it, because we're PC owners too. We share the pride of ownership you feel for your PC because we feel it too. We're not a bunch of crusty old professional cynics, feigning objectivity. We love this stuff and it shows.

If you ever have a question about an emerging technology, or need the inside scoop on some new gear, or want the truth behind the hype, or want to know just what the hell we were thinking, or just want to brag about your very own dream machine, simply drop me a line at **bdosland@maximumpcmag.com**. I assure you, I personally read every letter that comes in, so I can tailor this magazine to you.

So hop on and brace yourself, it's gonna be a wild ride!

Eadem mutata resurgo,



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Editor in Chief

MAXIMUM PC

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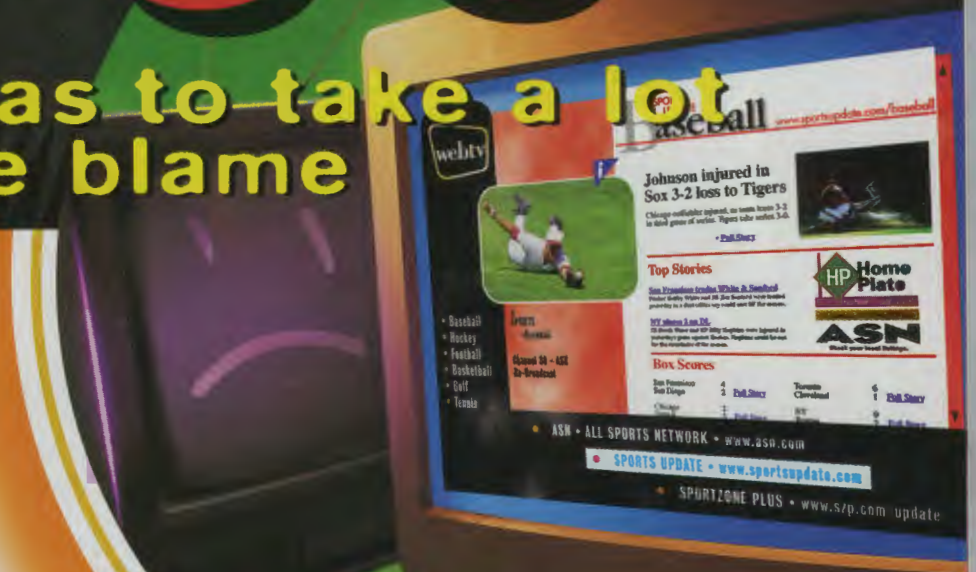

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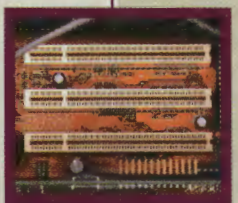
LETTERS FROM THE SMARTEST READERS IN THE WORLD

Hardware Addiction

As a magazine that perpetuates and even encourages the problem, I believe it is your responsibility to do an article on hardware addiction.

Hardware addiction is no laughing matter. Thousands of PC owners suffer from hardware addiction. Many of them don't even know it. The first step toward getting help is usually acknowledging that one has a problem, but few hardware addicts are cognizant of their condition or willing to admit it. Only their spouses, significant others, or close friends can see they have a problem, but by the time they see the signs it's often already too late.

Hardware addicts crave one thing and one thing only: power. They demand the most their PCs can give them-and then some. They can't stand not having the fastest PC on the block.



"They inevitably remove the cover from their new machine and find to their horror/secret pleasure... empty expansion slots!"

It starts innocently enough: They buy the top-of-the-line system. They take their new system home and plug in a game they've been playing lately. They cackle maniacally and clap their hands at how fast the game runs and how much better the graphics look on their new system. But at some point, it's bound to happen—they inevitably remove the cover from their new machine and find to their horror/secret pleasure... empty expansion slots! A voice deep inside their gnarled minds begins to chant, "Upgrade, upgrade, upgrade." They awaken from a deep reverie to find that they're hyperventilating. They go to their spouses with the suggestion that the new PC might run a little better if it had another Voodoo² card. The spouses frown. Deeply and darkly. That very night the PC addicts will surf the Internet and use their credit cards to purchase Monster 3D IIs or Pure3D IIs. They'll have the packages delivered to the offices via Next Day Air. When the parcels arrive, they'll install the cards under the cover of night while their spouses slumber unknowingly in the arms of danger.

How do you know if you're a hardware addict? If any of the following are true, you may, in fact, be a hardware addict: You buy a new PC every year. You can't stand to see empty expansion slots/bays and buy hardware just to fill them up. You buy games just to see how great your hardware works. If a friend buys a piece of hardware, you feel compelled to buy one too, but get something better and more expensive. Your PC has central air. Your monitor is bigger than your TV. You owe more on your credit card than the balance of your mortgage.

The madness must end! *Maximum PC* must report responsibly on hardware products! *Maximum PC* must stop making hardware sound so sexy!

—Ray Geroski

Sweatin' to the Oldies

I have a DX4-100 machine with 32MB RAM. Is it possible to overclock a 486-based machine?

—Kevin Bess

Technical Editor Sean Cleveland replies:
Oh yes, they are very overclockable. Try setting the bus to 33MHz and the multiplier jumper to 4.0 first. This will make your machine run at 133MHz. If that doesn't work, try changing the multiplier to 3.5, running the machine at 116MHz. If you have to reduce the bus down to 25MHz just to get the machine to run at 125MHz with a multiplier of 5, it may not be worth the effort. It's actually better to run at 100MHz with a 33MHz bus speed. If you're currently running at 25MHz with a multiplier of 4, at least change the bus speed to 33MHz with a multiplier of 3. You'll notice a difference.

AMDebate

I have finally found a product that actually lives up to the hype—the wonderful AMD K6-2. This was the first product I have ever bought that has worked perfectly straight out of the box and actually benchmarked as promised. I purchased this after reading your preliminary reviews and would like to thank you for convincing me to buy this wonderful CPU. I'm so thankful AMD came to my salvation and came out with something that could compete with Intel and that I could afford.

—Drew Wilson

Before people get all crazy, you have to hear my complaints about the AMD K6-2 processor.

1. It runs Windows 95 in the same time that my old Cyrix P150+! I notice almost no speed increase.
2. It is not as fast as a P-II 266—it posts a 90 bootMark! I was hoping at least a 120 bootMark.
3. When I overclock it to 350MHz, it doesn't power on.

Is this how AMD believes it's going to beat Intel? I don't think so.

—Alfredo E. Lopez

Be Afraid, Be Very Afraid

OK, I'm scared . . .

Since the release of DOS, Microsoft has always been a go-to company in my eyes. When I was old enough to buy my own computer, the first operating system I used was MS-DOS 3.1. I can still remember all the commands I used then. Currently I use Windows 95 and Windows NT 4.0, and I think both operating systems are good in their own way, but I can't wait for Win98. It sounds really stable.

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comport

I'm writing this letter because I'm scared.

I'm scared that the DOJ will bust Microsoft up into smaller companies. I'm scared that the rest of the vultures will swing in with their flavors of operating systems and cause absolute chaos. I know Win95/Win98, WinNT, Windows CE, even DOS are not perfect operating systems, but they are from one company. In our office, we're switching over from MacOS to NT, and some of the problems of "transferring" data have caused major setbacks and time delays. For every problem beyond our scope, we've been able to call Microsoft and get an answer to our questions. I can imagine the nightmare of new operating systems springing up all over the place and bringing the computer industry to its knees. You think you have problems now with Microsoft operating systems? What about companies that could be using four different operating systems from different companies under the same roof? That would be an absolute nightmare for any computer tech.

"While Microsoft has money coming out its ears and lots of smart people working for the company, so did IBM and Apple in their high-light years."

Looking at the huge company that Microsoft is, most people know that their hold on the computer industry is flimsy at best. While Microsoft has money coming out its ears and lots of smart people working for tit, so did IBM and Apple in their highlight years. Most Americans (and I am one of them) always think the grass is greener on the other side. If Microsoft falls, another company will be eagerly waiting to fill its shoes and continue that company's régime of products that dominate the market. I'm not saying we should sell out to Microsoft by any means, or buy more Microsoft products to keep them afloat. But I do think we need to look at Microsoft as a necessary evil that keeps the lid on the computer industry and tries to maintain some sort of compatibility.

—Matt Cummard

Professional Curiosity

As a SysAdmin for a plastics thermoformer, I have a bit of "professional curiosity." Who takes care of networking in the Maximum PC offices? Do you have an MIS department, or, in a land of technomavens, are things just done "by committee"? Do fights over individual upgrades result in bloodshed? Or has a certain editor in chief decreed, "There shall be no PC greater than mine"?

—Brad Spaulding

Editor in Chief Brad Dosland replies: Imagine Media provides an MIS department for all the publications here (*PC Gamer*, *Next Generation*, *MacAddict*, etc.), but *Maximum PC* is the bane of its existence. Every time the phone rings over there and it's one of the MaximumPCrew, they cringe. "Uhhh... my PC is smoking, and molten plastic is flowing through the vents. Can you fix it while I'm still working. I don't want to shut down." When they do get us away from the system and look under the hood, they discover a slew of unmarked alpha silicon from yet-to-be-announced companies running on beta drivers and alien technology. Lately they've been putting stickers on our cases that read "If this seal is broken, fix your own damn machine!"

As for my imperious decree, I'm currently chugging along on a P-Pro 200 while my minions breeze about on P-II power. But just wait till my Xeon arrives, then they'll feel my wrath.

Upgrade Your Eyes!

I'd like to know why people even care what happens beyond 60fps? The human eye can only register 60fps. That means the Voodoo² has us seeing (or not seeing) an average of 14fps over what our optic nerve can register. Once the 60fps to 70fps range is reached, the graphics people, hardware and software, should concentrate on bringing us stunning visuals.

—James H. Hughes

Executive Editor Jon Phillips replies: You're right. The typical human eye can't register framerates faster than 60fps. But that 60fps must be absolutely, positively locked in with

no dips whatsoever—any hiccups and the immersive experience is destroyed. Also remember that a particular 3D card might hit 75fps in a particular game, but only 35fps in the next big hit that features more polygons, larger textures, and richer special effects.

3D chipset developers therefore must concentrate on pure speed so that software developers can throw better visuals at us without sacrificing that locked-in 60fps framerate.

Sell Your Soundcard

I'm somewhat amazed with the soon-to-be Microsoft Digital Sound System 80, which receives its information via the USB port. It is my understanding that it is not connected to the soundcard, at least not directly. I'm very curious as how this all works. Is this something so new as to say that a soundcard is not needed for these new speakers?

—Jason Hamilton

Senior Editor Andrew Sanchez replies: Your PC will convert the audio signals into a straight digital signal that can be transported across the USB bus. Once it enters the speaker system, a Digital-To-Analog converter inside the subwoofer box converts the digital signal back into a format feasible for all the analog speakers.

The Microsoft speaker system is both a digital (USB) and analog device, meaning you can hook up the speaker via regular 1/8-inch mini stereo cable or USB.

In theory, a soundcard is not necessary if you go with USB, as your digital sound, equalization, and volume control will be routed into the USB port. The Microsoft speaker system will have its own control applet for volume, effects, etc., so you bypass any soundcard altogether. Although, if you do own a CD-ROM/DVD drive (and who doesn't?!), you'll still need to connect that device to something in order to get sound into your system—such as a soundcard.

We'll have to wait until we get final product in order to fully decipher Microsoft's USB plan.

"The human eye can only register 60fps. That means the Voodoo² has us seeing an average of 14fps over what our optic nerve can register."

Privacy Piracy

No matter what anyone says, you can't justify Blizzard's decision to read data off people's hard drives while playing their games online. By doing so, we are saying that anyone has the right to barge into our privacy, be it home or PC. My PC is my virtual home. And I do not feel comfortable having others barge into my home without me knowing and retrieving whatever they please. I'm sure there are other legal means of handling this situation, other than illegally retrieving data from peoples PCs.

I understand Blizzard's dilemma. But, like with any other authority in this country, there is a right way of handling these problems, and this is not it. Pirates aren't in the right, but two wrongs don't make a right.

Is the violation of our privacy a worthwhile sacrifice for catching a few criminals,

EXPERTS SAY THE INTERNET WILL BE TWICE AS FAST BY THE YEAR 2001.

WHY WAIT?

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even if those not pirating are also being violated? After all, they did find out that some were "manufacturing problems, stores that were reselling returned copies...." What of the law-abiding citizens whose privacy was violated? How do we justify that? If authorities seeking to convict murderers need warrants, what makes the software industry any different?

—Jack L. Crisostomo

I am demanding that *Maximum PC* execute an immediate and total recall of all current issues. This morning, as I was turning the pages of the issue, I received a lateral microincision of the left forefinger. That's right—a paper-cut. How can you litter the streets with such a patently dangerous product? Did you even bother to get this magazine safety-approved? And, as for the CD-ROM, I dropped it on my crotch, burning Mr. Bobo beyond recognition. (Wait—forget I told you that name.) Be assured, Mister(s), a lawsuit of elephantine proportion is heretofore, forthwith, and verily, uh, comin' at ya.

"My PC is my virtual home. And I do not feel comfortable having others barge into my home without me knowing and retrieving whatever they please."

Regarding this Blizzard nonsense (if I may be serious for a moment): Blizzard did the right thing. Perhaps it was poor execution, but it was trying to do right by its customers. Anyone who feels his privacy has been violated, well obviously you have something to hide. The rest of you who feel that Blizzard betrayed your trust by gathering system information for marketing purposes, I've got news for you: every time you use a credit card, shop at a major department store, register at a hotel, vote, go to a new doctor or dentist, or get arrested—people, your name is for sale. Big business has been keeping tabs on us far longer than the software industry has been around. Live with it and let Blizzard get back to making great games.

—Chabuhi

Config.Sis

I'm a woman who loves computer hardware and software. I get excited by it. I work for a software company, and today I tried to join a conversation with two men about hardware upgrades. I know about this sort of thing, believe me, through lots of hands-on experience. I've upgraded three systems, testing and returning a lot of inadequate hardware.

Well, all I got was blank looks from these two guys. And this has not been my only experience with the brush-off during computer conversations. I love computers and I love to talk about them, but men perceive women as unable to have a valid opinion when it comes to computers.

I see no difference in my passion for computers than any man's. Why then do I get laughed at or given the big cold shoulder when it comes to talking about computers? I admit no other woman in my office shares my passion, but I don't think I'm that unique. And I certainly don't see why anyone would be uncomfortable talking to me.

There's a comic going around the office where a woman asks her son why all games are written for men. The boy replies that women should stop complaining and program their own games. The son ends up in the corner facing the wall. But this is downright invalid. I love the games out now! They aren't geared for men or women.

Female *Maximum PC* readers, am I that unusual in loving games such as *Quake II* and *Blood 2*, and daydreaming about the latest in computer hardware?

—Heather Walton

Whither USB?

When will we get to use our USB ports?

USB ports have been in new machines since 1996, and I still haven't seen a single peripheral that uses it. When can we expect to be free of this multitude of cables we're currently forced to live with?

I long for the day when I can remove all those cables and just use a hub, plug them in, and not have to worry whether I have the correct cable type or whether it will fit into my computer.

—Michael Irving

News Editor Bryan Del Rizzo replies: Now that Windows 98 is unleashed on the w
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the market for a new

Pumping P
in Your La

What happened with
books?

unleashed on the world, you should start to see a proliferation of USB devices flood the market. We're working on a huge USB feature for an upcoming issue of Maximum PC, and already we've got a bunch of USB products, including cameras, keyboards, mice, hubs, scanners, adapters, and game controllers. Best of all, they actually work. Just plug 'em in, and you're on your way.

Online Shopping Binge

One late night not too long ago I ended up doing a bit more surfing than I had planned, and in the process purchased a 17-inch DEC VRC16-HA monitor. The next morning after the headache went away, I decided to check on my work the previous night. What I learned is that the monitor I had purchased had only five BNC-type video connectors. This caused me to do a little research, not being familiar with anything but the standard 15-pin units. One item of interest I did find was that most after-market cable manufacturers do make a 15-pin-to-BNC unit. What I want to know is whether I have just purchased a new boat anchor or I just got a stellar deal on the web.

—cw2

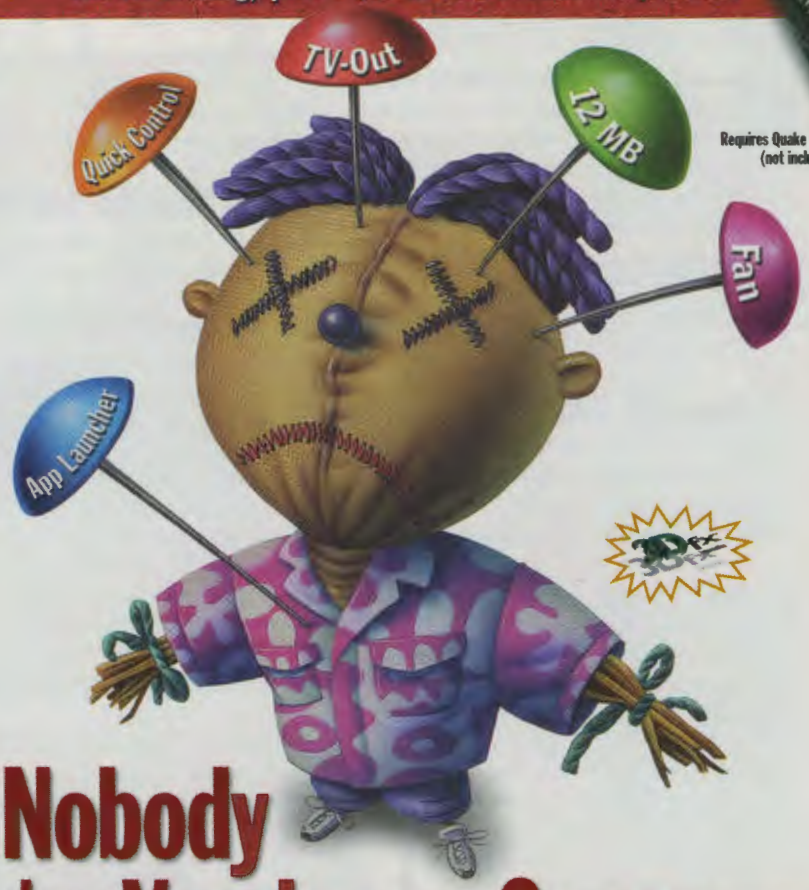
Executive Editor Jon Phillips replies: One late night not too long ago I ended up doing a bit more surfing than I had planned, and in the process purchased a 1,343-foot ocean liner. It too had BNC connectors. I blame those freaky international maritime specs. Anyway, it's strange that a manufacturer would outfit a 17-inch monitor with BNC connectors. BNC offers higher bandwidth video signals than 15-pin, and is typically the preferred connection interface for high-end 21-inch displays. Sure, you can use an adapter to get your monitor up and running, but your video signal will top out at 15-pin quality. If this solution doesn't appeal to you, I should let you know that I'm in the market for a new boat anchor.

Pumping Polygons in Your Lap

What happened with 3D cards for notebooks?

—Sergio Castaneda

Included with every Pure3D II & II LX– Quake II™ Mission Pack: The Reckoning,™ plus a $10 mail-in rebate on Quake II.®



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"Overall, the WitchDoctor casts a strong spell for a gamer's happiness, and wins big by providing the best foundation for a Voodoo2 card yet." – Craig Campanaro, Hardware Director www.cyrellis.com

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canopus http://www.canopuscorp.com

News Editor Bryan Del Rizzo replies: 3D chips, not cards, are already available for notebooks. In addition to the MagicMedia 256AV, we've also seen S3's ViRGE/MX and ATI's Rage LT Pro. Although they do provide Direct3D compatibility, they don't exactly give desktop Voodoo-based cards a run for the money. Still, they're a good first step into making notebook computers just as "video powerful" as their desktop brethren.

Son of AGP

What's the deal with AGP 2.0? I'm looking into replacing the mediocre AGP card that came with my P-II 266 with something with a lot more pixel-pushing power. I'm considering either an STB Velocity 128 (8MB) or a Real3D StarFighter. However, the StarFighter's specs on a vendor page state that it's an AGP 2.0 card. Looking through the motherboard manuals, the only thing I've been able to determine is that I have a 440LX bus. There's really nothing on AGP levels. I was hoping you guys could enlighten me. Basically, I just want to know if the StarFighter will work on my system. Also, while you're at it... What the hell is AGP 2.0?

—Alexander Aguilar

Executive Editor Jon Phillips replies: Your motherboard is outfitted with the 440LX core-logic chipset, which does indeed support the AGP 2.0–enabled StarFighter. And why shouldn't it? Intel makes both the 440LX and the i740 chipset used by the 3D card.

AGP is an Intel technology that lets your computer store 3D gaming textures in main system memory. Before AGP, textures could only be stored in the memory soldered to your videocard—about 2MB to 16MB worth as opposed to the 32MB to 128MB that's plugged into most computer motherboards. With voluminous amounts of texture storage space at their disposal, game developers can now use higher-res textures, and thus make 3D worlds more breathtaking.

The second version of AGP is simply a faster iteration of the spec. In AGP 1.0, the AGP data bus is a one-way street—the videocard can't request textures from system memory while system memory is sending textures to the videocard. AGP 2.0, however, introduces a "sideband" through which the videocard can send texture requests at the very same time when textures are leaving system memory and heading toward the videocard.

Two last things to remember: AGP doesn't mean jack unless you're playing a 3D game with extra large textures.

Web Hurts Service

I'm an avid gamer and work in a computer store chain. I believe the web degenerates customer service in most companies. Just look at the number of patches downloadable from the web sites of most major companies. I understand how much it helps, but how much does it hurt? Do companies send out games that are not completely done, knowing they can put a patch on their web site thinking this would satisfy us? When companies put out patches on disks, it cost the company. This made them put out a better product in the first place because they didn't want to spend the cash. The web makes its easier for them to have a lazy mentality and shoddy product. I'd be ashamed of putting out even one patch. I'd praise a company that sent out a patch that gave registered users new features, not fixes, for free. In fact, I'd support that company for life.

—Michael Kurtz

"Have I just purchased a new boat anchor or just a stellar deal on the web?"

My So-Called SCSI Life

I've had an Adaptec 2940W for four years and have rebuilt my computer three times around this card. I currently have a 1GB Seagate SCSI hard drive with an Iomega Jaz drive. All are SCSI 2. I'm considering adding a SCSI wide hard drive to my system but am having a hard time finding one. Can this card support SCSI Ultra Wide or SCSI 3 ?

—Luigi Tiberi

Tech Editor Sean Cleveland replies: No, it cannot. You would need Adaptec's 2940UW (Ultra Wide) controller or equivalent from another manufacturer. But if you're really going to take the plunge, you may want to look into Ultra 2 SCSI. Adaptec's Ultra 2 card is called the 2940U2W and is currently available. This next-generation SCSI offers a total bus width of 80MB/sec as opposed to Ultra Wide's 40MB/sec. Even though a single hard drive would never fill this, we have found that Seagate's Cheetah Ultra 2 d do indeed burst at 45MB/sec! Its throu put is also phenomenal at 16MB/sec, a seek times are at a steady 8.5ms. If spe is your need, then definitely look into t combination. If you have trouble findin these drives on shelves, it's due to lack demand. Most companies can order eq ment, and a list of resellers is usually av able from the manufacturer's web site.

Slow as a SnAOL

Why is AOL so slow? I can't get less tha 450 ping while I play *Quake II*. It takes seconds to even fire the first shot off m rocket launcher, and by then the perso moved. I have a 300MHz P-II, V.90 mod and I'm even using AOL's V.90 access li What gives?

—Dan the pissed-off g

Online Editor Gordon Ung replie AOL slow? Say it ain't so! You problem probably relates to th amount of traffic AOL handle with its millions of customers. networks really aren't configu to handle the intense gaming Quake II requires. There are a few tricks you might want to though. Some people have reported la being induced by the V.90 protocol. Tr dialing a non-V.90 line like a 33.6 line, turning software compression off unde advanced setting on your modem. You also want to try updating your winsock dial-up networking to 1.2. A great plac start is www.navpoint.com/~zephed/ qx2.html. The site has tips on configuri X2/V.90 modem init strings for optimu Quake gameplay. The final tip would b to switch to a true ISP. If you love AOL community forums but want an additio ISP for online gaming, you may want t change your rate plan to the low usag plans AOL has available.

The Rabbit Died

please help

i have become satisfied with my cur computer and feel no compulsion to upgrade it

please, please help me

i do however have an overpowering to overclock my vw rabbit

—Stephen D. Gogli

MEET THE CREW

Andrew Sanchez
▸SENIOR EDITOR

Andrew's the man in charge of the entire review well in the pages of *Maximum PC*. You'll see his name attached to many of our hardware features, especially anything related to 3D accelerators.

Sean Cleveland
▸TECHNICAL EDITOR

Sean's a freak for the geekier stuff: blazing hard drive spindle speeds, cool network hubs, CD-ROM drive architectures, flavors of SCSI. When not hobnobbing with engineers, he's in charge of the lab.

Rick Popko
▸SOFTWARE EDITOR

A grizzled veteran of *Multimedia World* and *Digital Video* magazines, Rick's brimming enthusiasm (not pictured) guides our coverage of the games, utilities, and apps that show off your killer hardware.

Bryan Del Rizzo
▸NEWS EDITOR

Bryan's the man on on the asking end of the hard questions in our monthly interview and in charge of the news section in print and online. Being on the road so much, Bryan's also the master of mobile tech.

Gordon Ung
▸ONLINE EDITOR

Gordon reads, edits, and posts the flood of letters that come into the magazine. With a daily newspaper background, crafty guy Gordon also kicks in on the news and soundcard coverage in *Maximum PC*.

Kenn Durrence
▸DISC EDITOR

Kenn's the guy who pulls together all the phat demos, utilities, drivers, and shareware that come on the Deluxe version of *Maximum PC*'s mega 650MB CD-ROM: Maximum CD. He also bats clean-up.

WE'LL LEAVE THE STARRING ROLES TO THE HARDWARE, BUT YOU'LL BE HARD-PRESSED TO FIND A BETTER SUPPORTING CAST ON ANY BACKLOT IN THE BUSINESS

Brad Dosland
▸EDITOR IN CHIEF

Our own Svengali, Brad tries to get everyone on his suspiciously dedicated staff to spend every waking hour in our cramped office (must be those blazing blue eyes). He's held almost every position in publishing on magazines such as *boot* and *Thrasher*.

Jon Phillips
▸EXECUTIVE EDITOR

Straight from the mean streets of Richmond, CA (with a layover at *The Net* magazine), Jon's the man who crafts the feature well of *Maximum PC* every month. He's also become a CPU guru.

Sarah Pirch
▸MANAGING EDITOR

The flaxen-tressed Sarah came to *Maximum PC* from *Unix Review* and reads every word in the magazine each month. In addition to her language skills, Sarah stays hands-on with the mouse beat.

Kevin Ashburn
▸ART DIRECTOR

Kevin was a freelance designer for *boot* magazine. He was hired as associate art director, and by noon that first day he was the full-fledged art director. He's just that good... and he's willing to work insane hours.

Sherry Monarko
▸ASSOC. ART DIRECTOR

Eclectic Sherry is our colorful spark plug. In addition to lay out chores, Sherry makes sure all our pages are prepped and ready to go to the press. She also spearheaded the design of our web site and Deluxe CD-ROM.

Linda Aldredge
▸GRAPHIC DESIGNER

The newest member of the Maximum PC team, Linda has lent her design skills to *PC Games*, *Mother Jones*, and *surface* magazine. Her arrival at the magazine immediately attracted a bevy of amorous stalkers.

Gene Burns
▸PUBLISHER

Gene's been the biz force behind some of the most successful magazines in tech publishing, such as *NetGuide*, *Home PC*, and *Windows* mag. His tireless drive is a motivating force for all at *Maximum PC*.

You know the feeling. It sets in around the 5th or 6th pot. It's a bit beyond the traditional adrenaline rush. Well, that's what it feels like when you get to the 5th and 6th cylinders in Dead Reckoning. And with 9 more cylinders left to conquer, each featuring a more challenging alien opponent than the last, you'll be wired for days.

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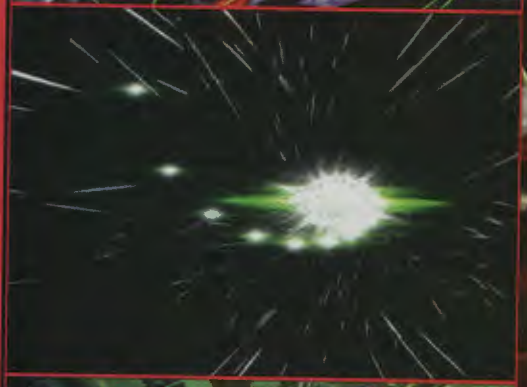

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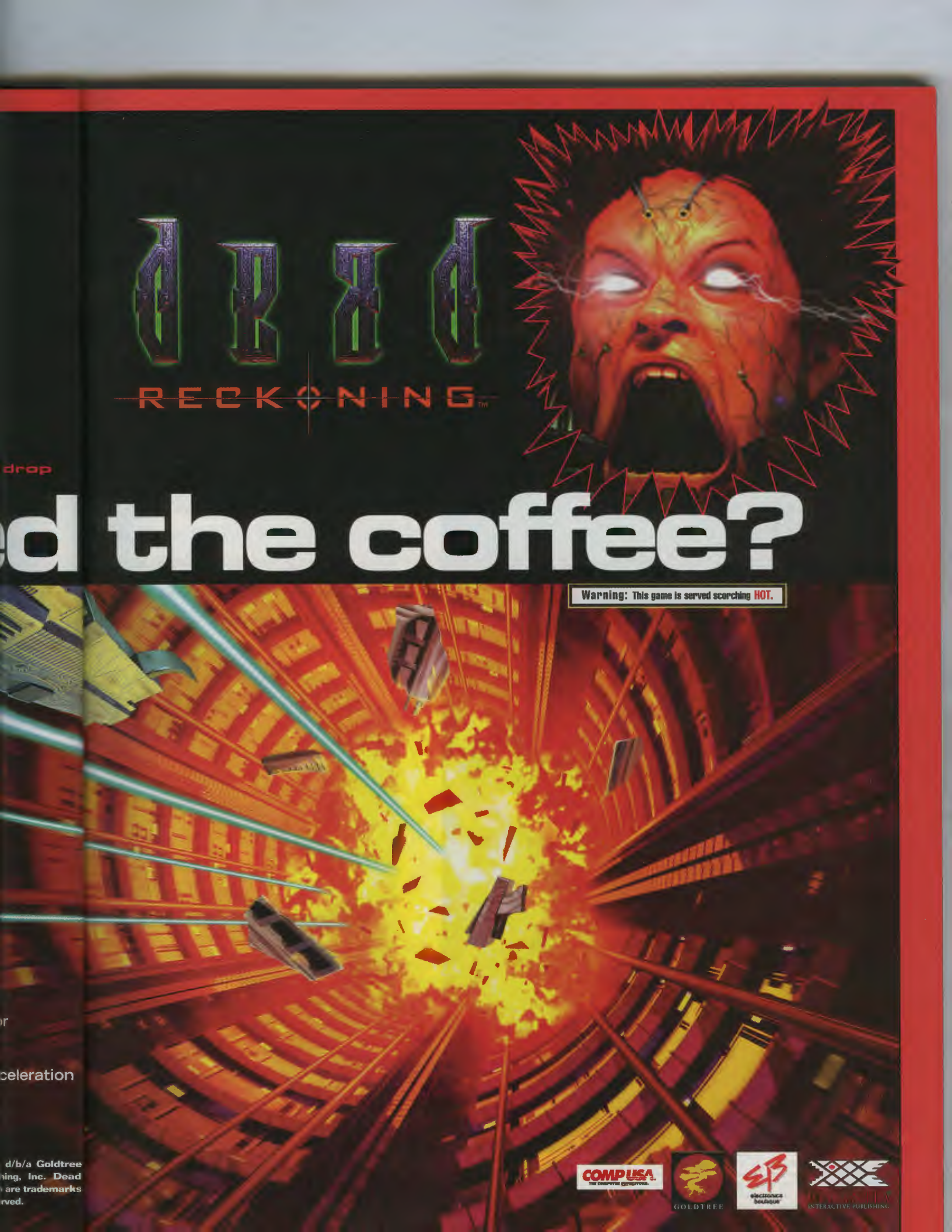
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Who hasn't been there when someone's started dealing business cards as if it were a game of five card stud? The Palm III™ connected organizer lets you dispense with that ritual – without gambling with your precious information. Now infrared transfer makes it possible to transfer your business card and other information (including applications) directly to and from other Palm III users. And HotSync® technology lets you exchange data with your PC – great for quick backups and seamless data entry. Of course Palm III still keeps track of appointments, contacts, to-do lists, e-mail and expenses – and applications created by thousands of developers make this organizer even more powerful. Palm Computing products are the fastest selling handheld computing products in history and soon not having one will be like running out of business cards – a big business faux pas. For a Palm III retailer near you, visit www.palm.com or call 1-800-861-2529.

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LCD shows time left, date and time, and more

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With the $9,000 iCam, you can be in two places at once. Using telepresence technology, users can see and hear a remote location, almost as if they were there. Web-based controls allow for tilt, pan, and zoom. Companies will love the way the camera can superimpose their logo or other graphics on the live image. Pre-programmed camera settings are only a mouse-click away. How cool is this? Software controls enable different data to be displayed onscreen depending on what the camera is looking at.

Perceptual Robotics, Inc.
www.perceptualrobotics.com; 847.475.0512

◀ Sony 100 Disc Library

In need of an inexpensive solution for sharing a plethora of CD-ROMs? The Sony CDL1100 CD-ROM Library is the perfect, if not the only, choice in its price range. Packaged in a small desktop tower, this $2,995 100-disc changer houses two 12x CD-ROM drives. It uses a karaoke device for swapping discs, requiring only 12.2 seconds to swap a disc out. The SCSI-2 drive use a P-CAV architecture and delivers an average throughput of 8x (1.2MB/sec.), with a maximum throughput of up to 12x (1.8MB/sec.). The average access time is 130ms. SmartCD software gives you simple access to discs via Windows Explorer and only requires a single drive letter to access all CDs.

Sony; 888.531.7669; www.ita.sel.sony.com/products

Matrox iSwitch ▶

Targeted at home and small-office users, the $799 iSwitch is more than a simple hub, incorporating both switching and Internet access in a single box. Eight 10BaseT switched Ethernet ports offering a total throughput of up to 1.3MB/sec across the line. Two high-speed serial ports connect of up to two modems (28.8K, 56K, and ISDN), which can be accessed by all connected to the iSwitch. The iSwitch also acts as a firewall, preventing access to your LAN from intruders and prevents IP spoofing from hackers by mapping all internal addresses into one safe iSwitch IP address. All monitoring, reporting, configuration, and control is web-based software.

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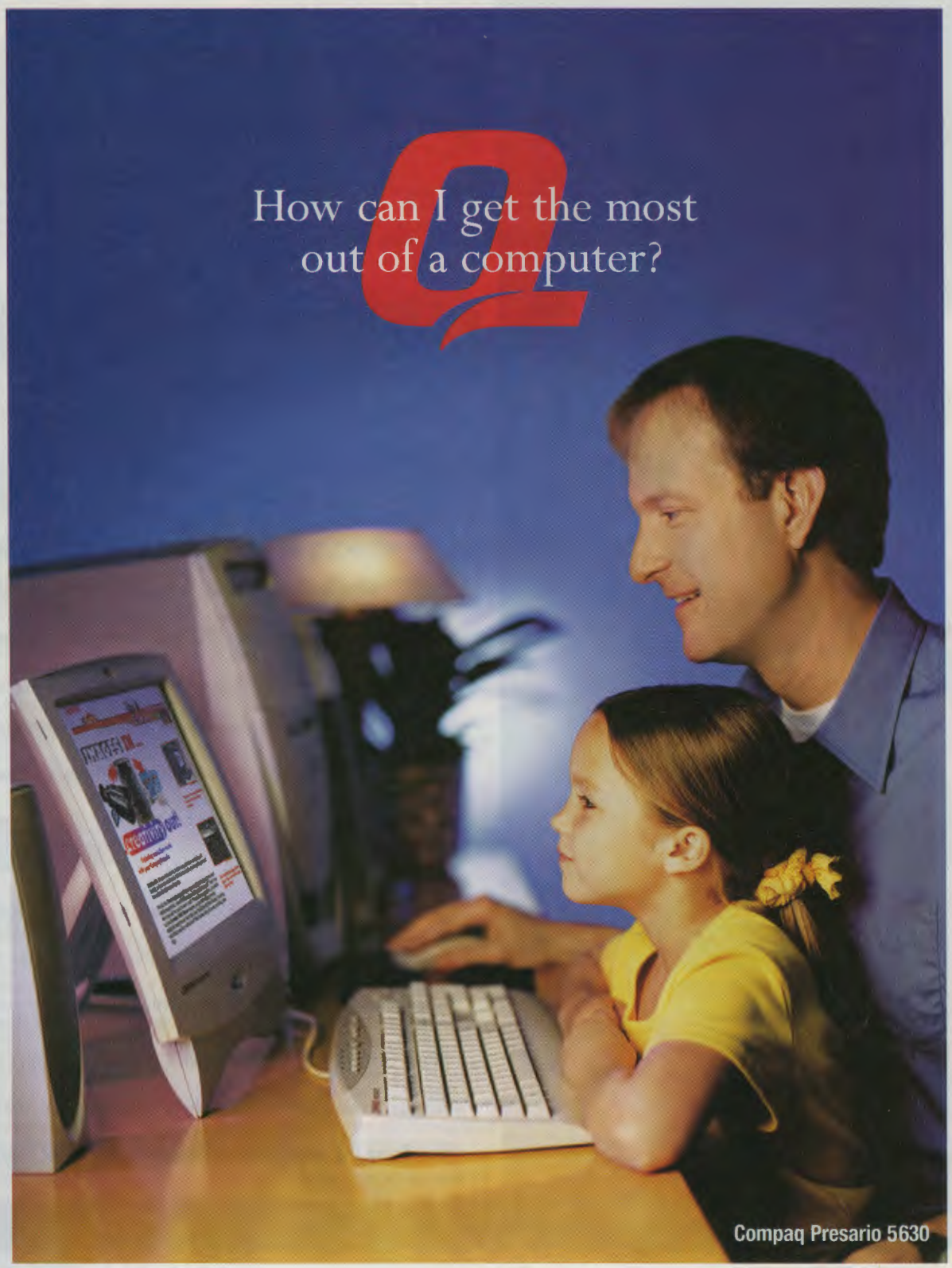
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Your Next OS Will Be Virtual

THE ULTIMATE OS LOOKS A LOT LIKE JAVA... AND THAT'S GOOD

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@maximumpcmag.com**

Alex St. John designed DirectOS—his dream operating system—so now it's my turn.

In some ways, my VirtualOS is similar to his, but with some twists—and I'll crawl out on a limb to predict that my approach is the wave of the future.

Like the Saint, I want to rip apart the OS kernel from the application programming interfaces (APIs). Today's leading OSes are criminally bloated. The more code there is, the more opportunity for bugs. And the main reason they're bloated is that APIs—the software layers that provide services to applications—are growing fatter than a sumo wrestler on a chocolate binge.

The low-level duties of an OS kernel haven't changed much in the past ten years. Yet, the ballooning bugs in high-level APIs are sabotaging the reliability of the kernels. It's time to separate the low-level functions of the OS from the higher-level functions of the APIs.

What does a kernel need to do? Not much, really. It needs to handle memory management, task scheduling, interrupts, device drivers, interprocess communications, and a few other critical functions. I'd store my VirtualOS kernel in switch-protected Flash ROM so it's upgradable if necessary, but immune to system crashes, evil viruses, and monkey damage.

Now, here's where my VirtualOS diverges from Alex's DirectOS. Alex would package the API libraries required by a program with the program itself. Every program installs its own APIs at runtime.

Frankly, his concept has a lot of merit. I like the idea of reducing the state information on a machine. But the unchecked growth of APIs might lead to horrendously bloated application packages over time. Also, I'd like to maintain separation between apps and APIs, just as I do between APIs and the kernel. That way, APIs can evolve without requiring anyone to repackage the apps, and apps would automatically take advantage of upgraded APIs.

So I would implement the APIs as a virtual layer on top of the kernel. Apps would arrive on the machine in the form of intermediate pseudo-code, not native code. The software installer would really be a compiler that converts the pseudo-code into native code without user intervention. Alternatively, a Just-In-Time (JIT) compiler could convert the pseudo-code into native code as the program runs, based on actual profiles of how you're using the program. JIT compilers optimize a program in ways that static compilers can't, because static compilers are oblivious to runtime variations.

If any of this sounds vaguely familiar, it's pretty much how Java works today. Java bytecode is intermediate pseudo-code that usually gets interpreted or compiled into native code at runtime. The Java platform APIs, which are written in Java, form a virtual layer that separates Java programs from the OS and the CPU. As a result, the system software and hardware can change at any time without breaking the APIs or your programs. Only the Java virtual machine and the compilers must be changed.

One advantage of a VirtualOS is that it would spur more competition for better OS kernels and CPUs. Software compatibility limits those choices today.

Another advantage is that VirtualOS software is cross-platform compatible, not only in the horizontal dimension (across multiple platforms that exist now), but also in the temporal dimension (across platforms that will exist in the future). The year 2000 problem teaches us that code often lives for 20 or 30 years. Can you predict which native platforms will be popular then?

A reasonable objection is that a VirtualOS is too slow, especially for games. Point well taken. But while progress is underway to boost Java performance, it'll never be as fast as plain C code or assembly language. That's OK, because Java allows programmers to call native code if they need more speed, and my VirtualOS would, too. Games fall out of fashion faster than other software, so long-term compatibility isn't so important.

I'm not saying Java is the ultimate solution. I consider Java to be VirtualOS 1.0. Even if Java fails as a platform, the concept won't die. It has too many advantages for users and developers, and the idea has been planted in too many brains by now. Another VirtualOS would rise from the ashes to fix the problems that killed Java. Eventually, a VirtualOS will succeed.

And there won't be only one VirtualOS—there will be several. Some might be designed to run business software, while others might be optimized for consumer software. Someday, all platforms will be virtual platforms. In fact, I'd bet money that somewhere deep inside a secret lab in Redmond, Microsoft is working on one right now. ✹

On-site maintenance isn't available for a Voyager probe that's circling Saturn, so the OS had better be able to recover from errors on its own.

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ON THE LINE

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Web Whacker

TRACKING ELUSIVE PORN ONLINE

I recently made a shocking realization. In all the columns and articles I've written about the online world, I've never covered the topic that's easily the most obvious: Porn.

Articles about the legal quandaries surrounding the issue are plentiful; the shutting down of ISPs, pushy government regulation, and how porn exploits women and children (and farm animals). We don't need to go there today.

It's also easy to find reams of blue-nose reports railing on about how online pornography is leading to the decline of western civilization (and millions of hairy palms). It's more difficult, but still possible, to find pro-porn articles. Pieces exist that maintain porn actually empowers women, gives sexually frustrated "weirdos" a safe environment to act out their "twisted" fantasies, and is one of the only economically sound ventures on the entire web.

But it's almost impossible to find mainstream articles that explain the nuts and bolts of online pornography. How do you get it? Can it be discreet and secure? And how do you pay?

To get an overview of how Internet users think about the subject, check out Survey Net's sex questions (**www.survey.net/sv-sex.htm**). Over 25,000 mostly heterosexual males (74%) in their twenties (more than 50%) have responded since October 1995.

Highlights include:
–32% say the Internet has made them more open-minded
–19% say the Internet encourages perversion
–10% say the Internet promotes deception
–56% download erotic pictures
–22% talk dirty in IRC

Go to the site and answer the survey to get the rest of the sundry details.

But how to find the action online?

The obvious: Yahoo and Alta Vista. The word "sex" pulled up a mere 2,226 sites on Yahoo, but it piled up a staggering 3,844,209 on Alta Vista. Clearly Alta Vista gets you miles more sex-related content, but it's also in a million different languages, and in no particular order.

To help filter through the noise, some engines cater to your kinks. But beware: Many of these are just fronts for push sites that blast you with self-spawning banner windows for pay-to-play sites, very few actually offer impartial reviews. The best resource is Jane's Reviewed Adult Links at **www.powerotic.com/Jane/**. This site is both well organized and well designed, reviewing the entire gamut of sex-related sites. And the reviews are professional and intelligent. It also includes weekly picks, a special "for women" section, and consumer tips.

A reasonable alternative is Persian Kitty at **www.persiankitty.com**. It's more of a Yahoo-esque listing with links to nearly 1,000 web sites, categorized and alphabetized. It's a little too blinky blinky for my tastes, but it gets the job done. It also has quick links to sites offering free goodies.

As far as required hardware and plug-ins, the sex industry is not technology shy. In fact all the bells and whistles behind the scenes often require well-hung machines with accessories such as QuickCams and video players to get the most out of your online rendezvous. Remember: online sex is mega money, so the purveyors can afford top-notch programmers.

Surfing at work? Worried about privacy? A few tricks offer to keep the rubbernecks at bay. First, to hoax your admins, make sure to go through a private back door that hides your identity. This will also keep header hunters from getting your e-mail and IP addresses for future unwanted pornspam.

The easiest free way to do this is with Anonymizer at **www.anonymizer.com**. The service also offers for-pay accounts ($15 a quarter), which are much quicker because the company says it reserves bandwidth for those with cash. Anonymizer employs a web proxy that filters out headers and source addresses. But security watchers take note: no chaining, encryption, or log security is built-in according to a privacy report found at **http://www.cs.berkeley.edu/~daw/privacy-compcon97-www/privacy-html.html**.

If you don't want to get caught looking—even anonymously—use an offline web agent (a web snake). While you're running Excel on the desktop you could be happily using one of the tools from several companies such as Milktruck (**www.milktruck.com**) or the Maximum PC crew's favorite, Anawave (**anaserve.com/anawave/web-snake/**), to download the content for later, more private, viewing.

The payment structures vary. Many sites participate in AVS (Adult Verification Services) content networks that take your cash monthly and verify that you're over 18 (to protect the sites). Payments from $1.95 to $19.95 per month seem standard.

Adult Check, probably the best deal, offers 13,000+ sites for one year at $16.95. Adult Check Gold, at $14.95 per month, promises the best sites on the Internet. "Jane" speculated that this new system is an answer to third parties passing old passwords (such as Pirate Lynx—**www.pirate-lynx.com**) to the masses and cutting down Adult Check and the web site's profits.

Sixties free love may be over, and the age of lusty disco has passed, but there's no mistake that any tango you could possibly imagine is ready and waiting in the playroom of your choice online. Oooh baby baby. ✹

The sex industry is not technology shy. In fact, the bells and whistles behind the scenes often require well-hung machines to get the most out of your online rendezvous.

GAME THEORY

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@maximumpcmag.com.

Why We Game

THE RARE GREAT GAME TRANSCENDS THE MEDIUM

However large the wads of sputum clogging the cogs of computer gaming may get, a precious few jewels of quality always manage to remind us what this medium can do. We may be drowning in a sea of mediocrity, but there are always islands of quality to provide refuge.

That's why we bother.

As I've said before, no matter how few good games come out each year in proportion to the bad ones, there never seems to be a shortage of quality games. That was brought home to me this week when I finally finished, after some 100 hours, Might and Magic VI. One-hundred hours away from family and friends, stuck in front of a flickering monitor that is probably, at this very moment, rendering my sperm inert. I have people to see, books to read, a golf game in serious need of help, and a whole season of "She's the Sheriff" on tape that I haven't yet watched.

Yet almost every night I trudged out to my office and, for a few hours, went away to the world of Enroth to battle some adequately rendered monsters. Why? I had already filed my review, thus freeing me from any occupational need to finish the blasted thing. I had promising new games such as Unreal, Operational Art of War, and Freespace waiting, and indifferent games such as X-COM Interceptor and Vangers requiring evaluation. So why go back?

It wasn't just that I'd gotten so far that I felt, "might as well finish it." I actually enjoyed it. (If that sounds strange, consider my job: enjoying a game you are required to evaluate is pretty rare.) I even looked forward to it. And when the Hive queen was dead and Prince Nicolai had knighted us all, I felt a bit sad that it was over. (I was pleased that New World Computing lets you go back to Enroth after the endgame, to roam the countryside and finish off any quests or dungeons you might have missed, borne along by a level 90+ party.)

What explains the appeal of this antisocial experience? Traditional noncomputer games are the antithesis of computer games. They are a social experience. We game partly for the challenge and pleasure, but more as a way of interacting with other human beings. When it's raining at the beach house, you don't all go to your separate corners and play solitaire. You haul out the Risk board and a case of cold ones and crush each other.

And online gaming is no replacement for this social element. There's no chance to interact with fellow humans in a Quake II deathmatch. The times you do, you regret it as you realize many of the people playing are juvenile cretins in real life. I finally gave up most online action gaming because of the lame, testosterone-induced posing of the average player.

Good computer games offer something you can't find anywhere else: full immersion in a vast and interesting world. Neophytes may compare it to television or movies, but gaming is much more. Films and TV are completely passive, engaging neither the body nor the imagination nor the mind. All that games borrow from motion media is the motion: moving images on a screen.

Quality games are most like good novels. They draw you into a world that is partly the work of the creator, but partly the work (through the imagination) of the user. Instead of imagining the sensory elements as you do in a novel, you use your imagination to direct the action itself. The visual and aural elements are in place, but what you do with them is what engages and holds the user. This applies to every type of game, not just narrative ones. Strategy games succeed best when they create a world—be it a fantasy empire, a nascent civilization, or Gettysburg—and leave you to direct the "story."

Technology helps game creators offer more believable environments for this mental process, but in truth, it's not essential. Visually immersive games such as Sin, Unreal, and Quake II are not the most emotionally compelling. They hone in on one or two emotions—fear and aggression—and strike them over and over again. They can be exhilarating, like a roller coaster, but rarely engage the mind on a more subtle level.

Might and Magic VI, by comparison, is technologically inferior in almost every way. The framerates are poor, the textures aren't hardware-smoothed, the figure modeling isn't fluid. But the world has characters, stories, far-flung locations, magic, monsters, an epic battle between good and evil, heroes, and even a few challenging puzzles. The environment feels real not because it looks real (it often doesn't), but because the little details, such as an obnoxious clerk or snooty peasant, make it seem like a real place in time and space.

That's why there's hope for computer gaming. A medium that so completely engages the imagination is far too powerful to be surrendered to the Deer Hunters of the world. Through technology, entire realms of the mind may be evoked, and the control of these worlds is placed in the hands of average consumers for $49.95. And if that isn't the most impressive creative medium since the motion-picture camera, I don't know what is. ✹

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WATCHDOG

Maximum PC stands at the gate between you and them

Asus and Seagate UDMA Problems

Dear Dog I'd like everyone to know about a problem with **Asus P2B** motherboards and the **Seagate Medalist Pro** hard drives such as the ST34520A 7,200RPM IDE drive.

ASUS P2B motherboard

Although quite a few people in the Asus newsgroup are experiencing the same problem, Asus doesn't seem to have an answer. The problem occurs either when you use the Intel 3.01 bus-mastering drives or when you enable the DMA mode of the hard drive in the device manager and the Ultra DMA mode in the BIOS.

When you do this, the Win95 registry gets corrupted and you must reformat your hard drive. The fastest way of checking for this problem is to run scandisk in Win95. It will detect multiple copies of the FAT table.

The temporary fix to this problem is to disable all the DMA settings, but by doing this, your drive runs as slow as molasses. Basically it runs like a three-to-four-year-old hard drive using mode 4. This should piss off anyone who just spent more than $350 on the fastest EIDE drive in the market.

—Fred Kwan

Seagate Medalist Pro

The Dog We contacted Asus officials about the problem. Their response follows:

Asus We did a test for the ST34520A 7200 RPM on our P2B motherboard, and it works without the problems you described. The problem you have experienced may be due to older firmware on the hard drive. You can update firmware and try it out. We have not received a lot of feedback from the field of similar problems, at least there is no record of this being a known issue. Oftentimes, the information on the Usenet group on the Internet has similar issues clouded together that do not reflect the true situation.

The Dog We scanned Asus support forums and found several messages from people confused about this same situation. Some reported similar problems, while others said their hardware. Asus's reply didn't seem to be a satisfactory answer to us or to Mr. Kwan, who had this to say:

Kwan Asus should check its own support forums. I searched and found more than 100 posts on the problems with the Seagate drive and Asus. It seems to me that they're passing the buck. I'd like to know what firmware revision they had on their test hard drive and how I can get that firmware revision, because I've searched all over the Seagate web site and haven't found it. All I want is to have my hard drive working at 100% instead of just limping around.

The Dog Since the buck was passed, we followed the money to Seagate, which confirmed a compatibility problem. Apparently, the speedy 7,200RPM Medalist is too fast when used with the Asus P2B and the Intel bus-mastering drivers. But whose fault is it? Intel, Asus, or Seagate? Seagate product marketing manager Jack Schiffhauer graciously refuses to point the finger at anyone and says it is the shared responsibility of all parties involved. He did add that the particular hard drive has been used with more than 120 systems without glitches. Since learning of the problem, Seagate engineers issued a firmware update for the drive that makes it run reliably on the P2B. The firmware upgrade is available on Seagate's web site. People can also get the update by writing to disc-support@seagate.com. All shipping drives have been updated as well. Schiffhauer says Seagate takes pride in its products and its technical support and apologized if Mr. Kwan's e-mail was lost.

No Cyrix Fantasy For Me

Dear Dog I'd like you to let readers

won't be a game everybody can play. Although the box for Final Fantasy VII may say "100% Intel-compatible CPU required," it's not detailed enough.

After the game wouldn't work on my machine, I contacted Final Fantasy's technical support, which said "some older **Cyrix** chips are not completely compatible with Final Fantasy VII. The only way to solve this is to upgrade your CPU. Best Wishes, Eidos."

That's it. Did Eidos mention anything about a patch in the works? No. Did they mention this on a single boxed copy of Final Fantasy VII?

With dozens of games using their own 3D engines, what makes Final Fantasy VII so awesome that it had to use Intel-specific assembler instructions? Eidos says its game is compatible with anything that is DirectX 5.1 compatible, which a Cyrix 686 chip is. Shame on Eidos, and shame on the game's developer, Squaresoft, for making fans wait so anxiously, only to be let down.

—Shaun Thomas

The Dog We contacted Frank Hom, a producer for Final Fantasy VII, who defended the company and product. Hom says the problem lies in the CPU, not the code. Developers wrote the game to a certain spec, and certain Cyrix 686 CPUs didn't meet that spec, he says. Final Fantasy VII uses a time-stamping function in the CPU that the Cyrix chip does not support correctly. While Eidos tries to ensure that its games are compatible with most CPUs, it was impossible to change code for just one CPU, Hom says. Newer Cyrix CPUs are compatible and run Final Fantasy VII without a glitch, he says.

Final Fantasy VII

But you're not totally screwed. Despite what customer service told you, Hom maintains that the companies

STRATION BY SCOTT LAUMANN

Squaresoft has supplied source code for Final Fantasy VII to Cyrix to help it create a patch. Keep your eyes on the Watchdog for an update when this patch is available.

Wrong Tool For The Wrong Job

Dear Dog In 1997, I bought a "cutting edge," highly acclaimed, multiple-editor's-choice-award-winner **Number Nine Imagine 128 Series 2e**. Yes, I was impressed by its apparent speed, and the visual clarity was a wonder to behold.

But in DirectX, the card is less than impressive. I couldn't initialize many games requiring DirectDraw or Direct3D features without error messages. It began to look as if the videocard was the culprit. A visit to Number Nine's technical support provided updated drivers that were Windows Hardware Qualified, and a couple of optimized drivers that supposedly improved on that. OK, I thought. Number Nine is on top of things.

But nothing worked. I despaired for days, poring over my system's software and hardware trying to derive a fix, but without success. These were 2D software titles requiring only DirectDraw, so I wasn't asking too much out of my Imagine 2. I was willing to suffer framerate performance hits; I just wanted to make the games work. You see, I paid a whopping $335 for the videocard and couldn't bring myself to spend more so soon afterward.

So, I contacted Number Nine's technical support. I was told to uninstall DirectX, uninstall Imagine 2's drivers, uninstall the game, and reinstall everything using current drivers. This would work, I was told. The card was DirectX capable. But this didn't work. So, I contacted Number Nine with this information and was flatly told to buy a 3Dfx card. This would solve my problems. I told Number Nine this was not acceptable, if they wanted me to have a 3Dfx card, then they should send me one. The Imagine 2 was capable and certified to run the games, even by Number Nine's own claims.

"Please ensure you have the latest drivers," I was again told. "Make sure you have installed everything correctly," I was told. I'm no computer invalid—I checked myself over and over. Everything was done correctly and should have been ready to go. Number Nine assured me they would not abandon me. This had to be a driver problem, I pleaded: "Please get some updated drivers for this blasted $335 card!"

The Number Nine Imagine 2e cards, which were so highly acclaimed when they were released, were marketed way past their expiration date, and Number Nine won't take responsibility for it.

—Paul Stock

The Dog **We contacted Number Nine officials, who said:**

Number Nine Per your e-mail we have updated our web site to include detailed instructions for loading drivers for support of Windows 98. I have provided the links below:
Revolution 3D **http://www.nine.com/support/docs/Win98/r3dw98.html**
Imagine 128 Series 2 **http://www.nine.com/support/docs/Win98/i2w98.html**
Imagine 128 **http://www.nine.com/support/docs/Win98/i128w98.html**
9FX Reality 334 **http://www.nine.com/support/docs/Win98/334w98.html**
9FX Reality 332 **http://www.nine.com/support/docs/Win98/332w98.html**
Index of all other Number Nine products: **http://www.nine.com/support/docs/Win98/index.html**

Regarding support for DirectX for the Imagine 128 Series 2, the card does support DirectX; however, the board does not support Direct3D very well due to the fact that the chip that drives the board does not support texture mapping. Without texture-mapping support, the chip/board is not a good performer in Direct3D games. The Imagine product line, both Imagine 128 and Imagine 128 Series 2, were never sold as gaming cards. They are, however, great in VESA 2.0 support, where you get 128-bit support.

Number Nine

I would strongly recommend that the user consider a 3Dfx add-on for the best of 2D and 3D for his particular needs.

The Dog **While it's not the most positive resolution to Mr. Stock's problems, it's refreshing to see a company recommend someone else's product when theirs doesn't fit the bill.**

Rocket Jockey Glide Hockey

Dear Dog A couple of months ago, I read a magazine that mentioned a patch that enables 3Dfx support for Rocket Science's game **Rocket Jockey**. The magazine in question said to call SegaSoft, which would then send out a CD. I did that, but was promptly treated like a leper and told that this patch was just a rumor. What gives?

—Pete Leeman

Rockey Jockey

The Dog **Since Rocket Science no longer exists, the Dog contacted SegaSoft to find out the real scoop behind this elusive patch. Here's what we found out:**

1. Although a 3Dfx version of the game was originally planned, Rocket Science unfortunately disbanded before a patch could be completed. Therefore, a 3D-acceleration patch for 3Dfx cards doesn't really exist.

2. A CD containing the most recent build of Rocket Jockey (plus other goodies such as support for LAN play and force-feedback joysticks) was being sent out to people who contacted SegaSoft directly. Unfortunately, the CD was marked as a "3Dfx version," even though it didn't actually include optimized code or drivers. According to Greg Chiemingo, SegaSoft's director of communications, "When the game was first released, there was an incompatibility with the DirectDraw drivers and 3Dfx cards. We released new DirectDraw drivers that enabled users of 3Dfx cards to play the game, but people mistakenly thought we had released a patch containing 3D acceleration."

3. Greg also apologized for the way you were treated on the phone. "That kind of unprofessional behavior has never been and will never be tolerated here," he said. "We pride ourselves on good customer service, everyone here, with everyone we deal with."

Diamond s A Jewel

Dear Dog Let me tell you the little story of my customer "service" experience involving **Diamond Multimedia**.

After seeing the impressive product Diamond manufactures (the Monster 3D videocards), I decided that I should purchase one for fun. After all, I work a great deal on computers and think gaming should be enjoyed to its fullest once the work is done. So I drop the $175 (Canadian) for

the older Monster 3D version, as I know that the performance is still quite impressive. After getting my card home, I installed the Monster 3D card (I've been installing hardware for seven years now) and booted up my machine. Well, I *tried* to boot up my machine. You see, as long as the card is installed, my machine won't boot.

After going to Diamond's site, I tried all relevant solutions to my situation. After two hours or so, nothing helped me out. At this point I was mildly irked at the problem.

So I e-mailed support for a hand with my problem. I was immediately notified of the further steps needed to complete my e-mail request and told that I should hear back in two to four business days. I e-mailed back my BIOS version, driver info, etc. (which took me about 30 minutes to compile) and waited for a response that would open a dialogue to assist with my problems.

And waited. And waited.

Five business days after my first request for help, I decided to call because I was getting a little agitated at the delays. I called the non-toll-free line and was greeted by a friendly voice that told me that my call would be answered shortly by a representative. And he told me again and again that my call is important.

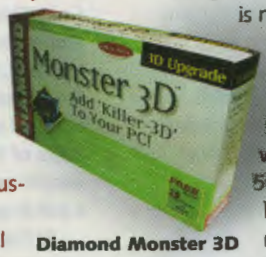
Guess what? He told me that for 73 minutes! From Canada, that's 25 cents for every minute. That's $18.25 for nothing. Why nothing you ask? Because as my call was finally transferred, I was disconnected by the network. You can even begin to imagine the expletives that escaped my mouth at that moment.

But wait—it gets better.

Furious, I called the toll-free customer-service line (I wasn't paying for nothing again) where I was greeted (after a 17 minute wait) by a friendly CSR. Mustering all the restraint I could (it's not her fault), I explained my situation, and she politely transferred me to another group, where I waited an additional five minutes. I was greeted by an equally polite CSR who asked me to reiterate the story. Once I (again, with great restraint) explained my situation she told me that it's no problem to get a callback from technical support. Just to verify the validity of that claim, I asked how long it would be, to which I received the response "Right away!"

Finally—progress. Except the call that was coming right away never came at all. So here is the reality of the situation. I feel as though I will never spend my time or money on one of Diamond's products again. Now multiply that lost revenue by the number of people in my situation and you get the picture. Too bad Diamond's service doesn't "shine" as much as its products. As Quark is finding, it takes more than good products to survive.

—Issa Breibish



Diamond Monster 3D

The Dog **Ouch! Knowing the reputation of Diamond's polished products, we contacted a company official about Mr. Breibish's problem. A Diamond spokesperson contacted Mr. Breibish with this:**

Diamond Dear Maximum PC Reader and Diamond Customer:

Recently you wrote a letter to Maximum PC detailing an experience you had with Diamond Multimedia's technical-support process, and we are sorry about the frustration and inconvenience you encountered. Our goal is to keep the technical-support hold times to an average of four minutes or less. While I agree that continued improvement is needed, we frequently meet that goal—especially for Monster 3D support calls. During the month of June, the same month of your call, we met or beat our goal over 50% of the days. Our average hold time was below six minutes 92% of the days in June. Since our records do not show a call hold time close to 73 minutes on the day of your call, we suspect that your call may have been misdirected by our phone system. This may have resulted in your call never ringing at the desk of a support representative. Our phone system specialist has been asked to put in place a plan to avoid this happening in the future.

Additionally, in response to the issue of why you did not get a return call from our support group, I can only say the callback request must not have been processed correctly to ensure a callback. Our goal is to return calls within 24 hours.

Lastly, as far as our automated e-mail process, this service is designed to give our customers immediate access to common issues 24 hours a day. More than 60% of our e-mail interactions are handled through this automated service. The instructions our customers receive after requesting a support document include directions on how to get support from a technician should the automated service not provide you with an answer. We hope you will try this service again in the future. It has greatly improved our ability to assist our customers.

I'm confident our follow-up since your original Diamond technical support contact has been satisfactory.

Regards,

Jim Hafner-Eaton, Director of Technical Support, Diamond Multimedia Systems

The Dog **We gave Maximum PC reader Issa Breibish a chance to respond to Diamond to see if he was happy.**

Breibish I just got a call from Mary at Diamond Multimedia. She asked if I had had my issue resolved yet and I told her that I hadn't. She seemed surprised. She was very polite and assured me that the director of technical support at Diamond Multimedia would call me to determine what the problem was with my card. She has also promised to send me out a Monster 3D II, at no charge, for my trouble. With technical support calling I'll be able to get an RMA number and return this card to the reseller.

After letting me know what I was to receive as compensation (an unexpected event, but very appreciated), Mary willingly opened a dialogue as to my thoughts and feelings about the whole ordeal. I answered honestly, reiterating many of the points made during my letter. Mary thanked me for bringing the issue up and assured me that steps would be taken in the future to prevent situations like this from arising. Mary then gave me a direct line to her if I should need anything else.

All in all, it seems that everything ended on a positive note. Diamond Multimedia may look at its strategy for interaction with its customers on the support end of things. And I got more than I bargained for and the support needed to use it.

I'm still a little leery about dealing with Diamond Multimedia—I would have to see evidence of some changes before buying again—but I would [buy again] if those changes happened. People like Mary give me faith that there is accountability by these companies.

Give the dog a bone and submit your consumer problems, scam alerts, and gripes to thewatchdog@maximumpcmag.com. While the dog promises not to get to everyone's complaints, the dog will try to resolve some issues.

Feds Go on the Offensive

DOJ/FTC launch two-fisted attack against Microsoft and Intel

Paratroopers rain from the sky. G.I.s storm the beaches. And tanks clank across the Rhine. It's D-Day, circa 1998, with the federal government launching a full-scale invasion of the Wintel Empire.

If you've been sleeping under an Amiga since the 1980s, you might not know Wintel. The alliance runs an estimated 80% to 90% of consumer PCs. Probably yours.

In twin assaults from the east and west this past spring, the Department of Justice and Federal Trade Commission sued Microsoft and Intel, respectively, accusing both of anticompetitive acts and unfairly leveraging their monopolies against corporate customers and competitors.

Using Microsoft's own documentation as ammunition, the DOJ accused the software giant of plotting the death of rival browser vendor Netscape by forcing consumers to use *Internet Explorer 4.0* in the new Windows 98 operating system. The government says Microsoft recognized the threat a browser-centric, Java-enabled world posed and wanted to slap it down.

The DOJ's documents include e-mail and memos from Microsoft CEO Bill Gates pushing hard for America Online to adopt *Internet Explorer* ahead of Microsoft's own online service MSN, effectively "putting a bullet through MSN's head."

Intel, playing Italy to Microsoft's Germany, stands accused by the FTC of bullying its customers and competitors, namely Intergraph and Digital, into relinquishing intellectual property or risk being cut off from key technologies. This is a more narrowly focused suit, and observers don't believe there will be a short-term impact on consumers. However, many predict the FTC's investigations are far from over and may act like a rock in Intel's shoe as it moves forward.

General Janet launches her litigious legions against the Wintel walls of Bill and Andy.

While both suits may seem esoteric to the average consumer, what's at stake, the government contends, is the incredible shrinking consumer choice.

But Microsoft and Intel argue otherwise. Microsoft claims its innovations have given consumers more choices and more software for far lower prices than before, while Intel says it was obligated to protect its property when it enters into litigation with a competitor or customer.

But some industry observers say otherwise.

"Both [suits] have been designed to protect consumers,"

SPIN CYCLE

This month's top stories broken down to the pertinent details

HEADLINE	NEWS	DETAILS	QUOTE	OUR SPIN
CompUSA Buys Computer City	CompUSA is now the owner of more than 90 Computer City stores, solidifying its position as the nation's largest computer retailer.	CompUSA buys the stores from Tandy for $275 million, despite sales being down more than 2% this year. John Roach, Tandy CEO who created the chain, is ousted.	"This acquisition will allow us to provide our customers with additional products, superior service, and added convenience," said James F. Halpin, CompUSA president and CEO.	Good. Now you'll have one less store to go to for lousy service and support.
3Dfx's Banshee Screams Into Reality	3Dfx has officially taken the wrapping off Banshee, its 128-bit 2D/3D video chip that promises intense 2D acceleration as well as excellent 3D performance.	Based on a single texelfx2/pixelfx2 Voodoo², Banshee is NOT a Voodoo²-killer. Specs include 1x AGP, 16-bit floating-point Z-buffer, bump-mapping.	"Banshee is a mainstream product," says 3Dfx, which encourages hardcore enthusiasts to step up to dual Voodoo² SLI for their maximum gaming needs.	We just got one in-house, but the drivers are too early to call. But the buzz is already negative.

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ILLUSTRATION BY SCOTT PECK

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its] have been
protect consumers,"

says James Love, director of Ralph Nader's Consumer Project for Technology. "Both [companies] are capable of crushing anyone who wants to play in the game."

"Both [companies] are capable of crushing anyone who wants to play in the game."
—James Love, Director, Consumer Project for Technology

Love says true innovation has come from outside the walls of Redmond, WA, in the last few years. He cites Internet development, Java, and a host of technologies that has sprouted outside the shadow of Microsoft.

Carlyn Clause, a San Francisco attorney specializing in anti-trust and anti-competition, agrees OEMs are stifled by Microsoft but said it's difficult to gauge the long-term impact on consumers. In the short term, Clause says, there are signs OEMs are beginning to "act like their own companies" again. Since the DOJ's action against Microsoft, companies such as IBM, NEC, and Gateway will offer customers a choice of Internet browsers.

"Knowing that the Justice Department is out there looking at Microsoft has probably given some companies the feeling that they are able to speak up when they would have been reluctant to do so before," Clause says. "Only time will tell what's really true. Is the market really competitive without government intervention or not?"

Love, who claims there is no competition now on PCs, says OEMs are still reluctant to try anything other than Microsoft operating systems or office suites. "What goes on PCs—and how it looks—is dictated by the secret licensing agreements OEMs sign with Microsoft," he said. He also suggests that although Linux isn't generally offered on most PCs today, it's rapidly continuing to grow under the free Internet development model.

"I'm looking at RedHat 5.1 now and it's cool," Love said. "I can tell you that given what I've seen in the last six months, if Microsoft isn't worried about Linux, than it should be."

With signs of closer scrutiny by the government, Love says we may see more choices when the smoke clears.

"Before everything is over I think Microsoft is going to have serious competition in its core area of the OS," he predicted. "A year from now you're going to see PC makers shipping OSes different and better than Windows."

As the months grind on, one thing that's up for grabs is how the suit will be viewed. An opinion poll by *Time* and CNN shows 53% of people opposed the government's actions against Microsoft, while 39% supported regulators. Similar polls across the country show strong sympathy for Microsoft and Intel, as well. So is it an Allied attack on an unholy union or a fascist assault on the free enterprise system by overzealous bureaucrats?

Attorney Hillard M. Sterling, who specializes in antitrust cases and information-technology issues, said he doesn't see either case having much of an impact on consumers.

"I don't believe Intel will materially alter its business practices," Sterling said. And in the DOJ case, where more "smoking guns" were evident, Sterling thinks regulators are faltering. "The government's case is unraveling," he said. "If the DOJ does not shift focus rapidly, its case will fall apart before our eyes."

And if the government does lose a battle or two to Intel or Microsoft, it doesn't mean the end of the war.

"Almost never does the government throw in the towel," said Sterling. "Notwithstanding the impeding potholes, this is a do or die time for the government right now."

At press time, the FTC's suit was slowly winding its way toward a court date on January 5, 1999. Microsoft is scheduled back in federal court on Sept. 8. ✹

Chronology

In its long battle with the government, Microsoft has played a hard game of brinkmanship more often than its Intel allies. The question is who will blink first?

1993 The Department of Justice begins a wide-ranging investigation into Microsoft's bundling packages and allegations of anti-trust violations.

1995 Microsoft agrees to a consent decree barring it from forcing OEMs to license other Microsoft products in order to have access to Windows 95.

1996 DOJ opens separate investigation into alleged violations of the consent decree. Netscape accuses Microsoft of giving OEMs a break on Win95 if Internet Explorer is bundled.

1997 Judge Penfield Jackson orders Microsoft to stop forcing OEMs to bundle IE and Win95. Microsoft cuts deal with DOJ to issue Win95 without IE icon on desktop but appeals order.

Intergraph files suit against Intel, charging it with attempting to bully away intellectual property.

March 1998 Federal and 27 states' attorneys general marshal forces.

April 1998 A U.S. District Court in Alabama orders Intel to sell parts to Intergraph and dresses intel down.

Former Senate leader Bob Dole and anti-Microsoft forces agree to lobby government officials to push for closer scrutiny of Microsoft.

May 1998 D-Day. DOJ and state regulators file two suits charging Microsoft with anti-competitive acts.

June 8, 1998 The FTC accuses Intel of cutting Digital, Compaq, and Intergraph off from key technology.

June 23, 1998 U.S. Appeals court overturns Judge Jackson's 1997 ruling.

Sept. 8, 1998 Microsoft's and regulators' scheduled court date.

Jan. 5, 1999 Court date for Intel and the FTC.

inent details

42 ▶

SPIN	HEADLINE	NEWS	DETAILS	QUOTE	OUR SPIN
ow you'll have one to go to for lousy nd support.	**Palm PDA Creator Jumps Ship**	Jeff Hawkins, vice president of Palm Computing (and creator of the Palm PDA) and general manager Donna Dubinsky, have left 3Com to start their own company.	They're leaving just as the Palm PDA family faces stiff challenges from Microsoft. Dubinsky and Hawkins have licensed the Palm OS.	"Now is a great time to leave because Palm is in such good shape," said Dubinsky.	If Jeff's newest products are half as good as the Palm PDA, we can't wait! Best of luck, Jeff and Donna!
got one in-house, but rs are too early to he buzz is already	**Diamond, Hercules, and STB Get Savage About 3D**	Even though the boards won't be out until this fall, Diamond, Hercules, and STB have all announced plans to get jiggy with S3's latest 2D/3D graphics chip.	The boards will include 8MB of local video memory, TV-outputs, and full AGP 2x compliance. Features include full hardware texture compression and 24-bit rendering.	"After evaluating Savage3D for 3D performance and quality, we clearly believe S3 has a winning product," said STB's Nathan Bozeman.	Based on our benchmarks (p. 86), this chip looks hot. It's good the industry hasn't lost confidence in S3.

The (De)Evolution of DVD-RAM

Drives finally emerge from primordial ooze

All emerging technologies require a maturation period to find their legs, but DVD-RAM has taken so long it seemed it might slip back into the soup.

Companies that promised DVD-RAM drives in early 1998 failed to deliver and are barely now starting up production. Panasonic shocked the industry at the end of last year by announcing it would have drives available in January. Turns out those drives were just for sampling. Mass production didn't ramp up until April, and it'll take a few months before Panasonic can seed the retail channel with enough product to quench demand. The demand is so strong, people are resorting to illegal activities just to get their hands on one. Case in point: Panasonic's first shipment of drives was stolen from under the noses of U.S. Customs officials in Holden, NJ, while en route from the manufacturing plant in Osaka, Japan.

In any case, DVD-RAM won't be a presence until the end of the year at the earliest.

So what caused the delay? Nobody is saying for sure, but rumors abound regarding low yields from production facilities due to mechanical problems on the production lines and instabilities in the firmware.

"We tolerated a few months of humiliation so we could deliver a rock-solid product," said Andy Marken, a Panasonic spokesperson. "The market wouldn't have forgiven us if we had hastily shipped a product that was dead on arrival or suffered infant mortality." Part of the delay, Marken contends, was due to copyright issues that had to be resolved before any product could be made available.

"We tolerated a few months of humiliation so we could deliver a rock-solid product."
—Andy Marken, Panasonic

Of course, it didn't help matters that the industry as a whole couldn't agree on a DVD-RAM spec. A 2.6GB spec was first approved by the DVD Forum in mid-1997. A week later, a faction headed by Sony, Hewlett-Packard, and Philips Electronics announced its own beefier 3GB spec, dubbed DVD+RW, which they claimed offered better compatibility with other DVD and CD formats. Of course, since DVD+RW was based on CD patents that Sony and Philips owned, they may have been motivated by revenue streams, rather than the underlying technology. Ultimately, survival of the fittest won out—the DVD Forum has since decided to adopt DVD+RW as a DVD-family format for authoring use, but is now simply calling it +RW. ✹

DVD-RAM Roster

If you're itching for a drive today, keep in mind the low yields are inflating prices. Once yields improve, they should drop by the holidays.

Company Panasonic
Drive LF-D101 (internal SCSI-2) and LF-D111 (internal ATAPI)
Type DVD-RAM
Pricing $600
Availability SCSI is shipping now; ATAPI version is due September

Company HiVal
Drive Panasonic LF-D101 (internal SCSI-2)
Type DVD-RAM
Pricing $500
Availability End of August

Company Creative Labs
Drive Creative PC-DVD (internal SCSI-2)
Type DVD-RAM
Pricing $500
Availability Shipping now

Company LaCie
Drive Panasonic LF-D101 (external SCSI-2)
Type DVD-RAM
Pricing $700
Availability Shipping now

Company Toshiba
Drive SD-W1101 (internal ATAPI)
Type DVD-RAM
Pricing $700
Availability Shipping now

Company Hitachi
Drive TBA
Type DVD-RAM
Pricing N/A
Availability Q4

DVD-RAM Media
Single-sided $18
Double-sided $30

DVD-R Media
Single-sided $40

SPIN CYCLE

44 ▶

HEADLINE	NEWS	DETAILS	QUOTE	OUR SPIN
AMD Reports Second Quarter Loss	Even with the successful launch of its K6-2 processor in late May, AMD found itself losing money—more than $64 million—for the quarter ending June 28, 1998.	Although AMD shipped more than 500,000 K6-2 processors in the quarter, declining sales from other divisions caused the loss.	"The Computation Products Group, which shipped more than 500,000 K6-2 processors, had an excellent quarter," said W.J. Sanders III, AMD's chairman and CEO.	AMD isn't alone. Weakening demand in the global semiconductor industry and increased price pressure are affecting everyone.
Avalon: A Computer Like No Other	Los Alamos National Laboratory builds new supercomputer, dubbed Avalon, that can crunch scientific data at 19.2 BOPS for only $150,000.	Under the hood lie 68 Digital Equipment Corp. Alpha processors running in parallel, all connected by 3Com network switches. It runs Linux, not Windows 98.	"Each of these processors theoretically is capable of performing over one billion operations a second," said Michael Warren of the Theoretical Astrophysics Group	But will it play Quake II?

Micron and Rendition Unveil Socket X

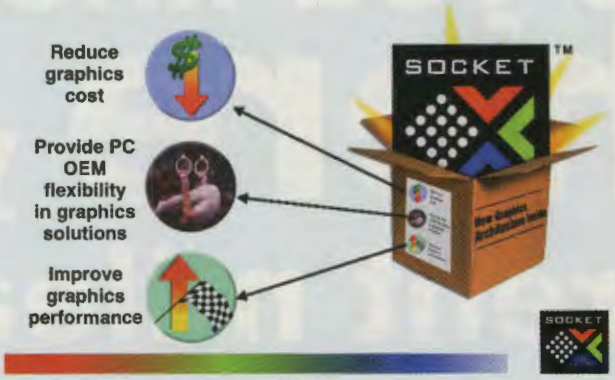
New graphics architecture faces uncertain future

If Micron, and its newly acquired subsidiary Rendition, have their way, soon you won't have to buy a 3D card to pop into your PC—a chipset will just plug onto the motherboard. Unfortunately, the pop-it-in and pop-it-out technology—dubbed Socket X—faces an uphill battle not only from OEMs who would have to modify their motherboard designs, but especially from graphics vendors, most of whom have been quick to dismiss the idea as a grandiose marketing ploy.

Socket X isn't a typical soldered-down solution, but rather a new socket standard—specifically for graphics chips—that would allow system OEMs (or consumers) to pull out the chip and upgrade to a faster one. At first glance, Socket X appears to be a good idea, and with motherboard real estate rapidly increasing in value, the ability to swap out the graphics sub-system without having to modify the internal design or mechanical configurations would likely be a boon to system OEMs. The concept is similar to what Intel is doing with Slot 1 and Slot 2, and a swap-out would require nothing more complicated than a quick BIOS modification. In addition, the spec also supports 2x and 4x AGP and includes two independent DACs (Digital/ Analog converters) to drive multiple outputs. It'll also include a 24-bit digital interface for the next-generation of flat-panel monitors.

Socket X will also employ embedded memory to increase the graphics pipeline.

"The fundamental problem is that the bandwidth for external memory will limit the next-generation video solutions," said Jim Peterson, Rendition's co-founder. "With embedded memory, you're not limited to a 64-bit or 128-bit bus. You can have as much memory as you want and have better efficiency because you don't have to go through so many layers of allocation of resources."



SOCKET X OUT OF THE BOX
In a perfect world, the technology could be a boon to consumers.

At the heart of the dispute is whether or not Socket X actually limits consumers' choices. "Having more functionality on the motherboard improves reliability, can lead to higher performance, and reduces cost," said Dean Klein, Micron's chief technical officer, "but the catch is that it almost

Socket X | 46 ▶

3D-Day Underway

Jim Peterson (co-founder of Rendition) tells us why Socket X is so important, and how the add-in card markets will be affected.

MPC Just what is Socket X?
Peterson It's a new graphics socket standard for the motherboard. You can pull out the chip, and upgrade to a faster one.

With Socket X, OEMs can choose very late in the game which graphics chip to include on their motherboard. And the graphics chip can be changed without having to modify the motherboard.

Motherboard real estate is really expensive, but because the Socket X graphics subsystem is just one chip, you can easily reduce the area required.

The fundamental problem we face today is that the bandwidth for external memory will limit the next-generation video solutions. Realizing that the jump in performance is approaching 5x per year, we've been talking with Micron Technology about the future in PC graphics. The products coming out this year are

46 ▶

SPIN CYCLE

46 ▶

HEADLINE	NEWS	DETAILS	QUOTE	OUR SPIN
448-Bit Encryption Approved	Computer Sentry Software has won the U.S. Commerce Department's approval to export its new 448-bit "Blowfish" encryption software, CyberAngel EXR.	Intended for networked computers, it lets employers recover employee encrypted data, but restricts other accesses, including those by law enforcement.	"Key escrow [retaining a copy of the encryption key for decryption by a third party] is still an invasion of privacy," says Chris Dibona, of SecureRemote.	The government should stay away from the cryptography debate. They're out of their league.
ESDRAM and DDR ESDRAM Approved By Memory Committee	The Joint Electron Device Council memory committee has approved Enhanced Synchronous DRAM (ESDRAM) as a superset of SDRAM.	166MHz ESDRAM combines two 4K 10ns SRAM page caches and two 8MB 22ns Fast DRAM banks on one circuit. The design should reduce memory latency.	"ESDRAM and DDR ESDRAM has an advantage over RAMBUS, and both are backward compatible," said EMS vice president Craig Rhodine.	A PC's chipset must support ESDRAM to see a difference in speed. Better make sure yours does.

◀ 44

probably OK, but as we go forward with 2D and 3D graphics chips, it became abundantly clear we would need a lot more bandwidth, and some kind of fundamental paradigm shift.

MPC Why employ embedded memory?

Peterson We'd thought about embedded memory for several years, but it wasn't cost-effective before. But because embedded memory will allow us to have 4MB, 8MB, or even more onboard memory, those bandwidth requirements will be met.

There's nothing really new to the concept of embedded memory, but the practicality of it has really come into play now as the technologies get to the 64MB+ region for the memory technology.

MPC You talk about swapping out the graphics chip. Won't this wipe out the add-in card market?

Peterson The add-in card market has a cost disadvantage and isn't primed for volume. I don't know if it will ever go away, but the real performers of the future are going to be Socket-type chips. Chips are finding their way down to the motherboard today, but because they're soldered down, you're stuck with it. With Socket X this isn't the case.

"The add-in card market has a cost disadvantage and isn't primed for volume."

MPC What about industry heavyweights such as 3Dfx?

Peterson The industry will move toward single chips for volume. Niche players may have some board-level products, but the cost-effective way to get performance in the long-term is with embedded memory.

That's not to say you wouldn't want to design a system that had a multiple-chip videocard for a really high-end product line, but the mainstream will be in single-chip embedded memory.

MPC So how does Rendition fit into the big picture?

Peterson We want to be a player in what we think is the mainstream. Expect motherboards and chips [from other vendors] to show up toward mid-1999. ✹

◀ 44 | Socket X

locks the user into one specific solution." Klein says Socket X's open architecture "solves this problem and is the only technology that can provide the memory bandwidth for continued improvements in graphics performance."

Unfortunately, the majority of graphics cards vendors disagree. "The rate of graphics innovation would be severely limited by Socket X," said Derek Perez, nVidia's public relations manager. "The constraints it places on packaging, pin count, and frame-buffer sizes would hurt OEMs and end users."

And not everyone is convinced embedded memory is the way to go. "Embedded DRAM technology is only used, at least in volume, in portable PCs where power and footprint are very highly valued," said Andy Keane, 3Dfx's vice president of marketing. Keane agrees that having a standardized pinout is a good idea for the PC makers, but said "embedded DRAM has not proven cost-effective enough or dense enough to meet the requirements of the mid-range and high-end graphics segment, particularly the needs of 3D gaming."

Of course, before Socket X becomes a reality, it'll have to be adopted and ratified by the industry's leading memory and system OEMs, and graphics card companies. Micron says it is trying to finalize a Socket X consortium by the end of this summer and hopes to have the first Socket X–compliant systems available next spring. Based on early reaction however, Micron's going to have a tough time getting anyone to hop on the bandwagon.

"It's going to be very difficult to line up a bunch of rodeo riders in the graphics business, corral them all, and move them all in one direction," said Terry Holdt, S3's president and chief executive officer [see Interrogation, page 50]. "There's a tremendous feud that all of us can do better than the next guy, and standardization brings a certain degree of leveling the playing field."

He may be right. Of the companies we spoke to—S3, Matrox, nVidia, PowerVR, and 3Dfx—none were remotely interested in implementing Socket X.

"Our direction is not to adopt Socket X until there is sufficient proof of its value and demand from OEM customers," said 3Dfx's Keane. "At this point, there is no proof or demand." ✹

SPIN CYCLE

HEADLINE	NEWS	DETAILS	QUOTE	OUR SPIN
Intel Announces New Processors	Intel has laid out its latest roadmap and it includes two brand new processors: Coppermine and Cascade.	Coppermine will lead a new desktop and mobile family, and Cascade is geared toward workstations and servers. Both will appear in late 1999 and adopt the .18-micron process.	"In 1999, we're going to deliver a number of new .18-micron processors—for all market segments," said Seth Walker, Intel spokesperson.	We don't care what the analysts say. . . we want more power! Bring 'em on baby!
AMD, Motorola Strike Copper Deal	AMD has penned a seven-year deal to use Motorola's copper interconnect technology to help its upcoming K7 (or K8) hit 1GHz clock speeds	Copper has better conductivity and heat resistance than aluminum and should result in smaller and faster CPUs. Motorola can also use AMD's	"Copper is necessary to increase processor speed and performance and represents a key element in our 'GHz 2000' goal," said W. J. Sanders III,	Read above comment.

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S3's Second

PROFILE

And he would be...?

Terry Holdt scores a hat trick as S3's current Chief Executive Officer, President, and Chairman of the Board. His latest stint marks a return for this white-haired wonder, who came out of retirement after previously serving as President, CEO, and a Director of the company from 1992 until 1996. Terry Holdt is S3's supreme god, overseeing everything from product development to packing materials.

And I would know him from...?

S3 used to be the leading manufacturer of graphics chips to the entire computer industry. But after its ViRGE chipset failed to wow gamers, the company found itself in the unenviable position of having to play 3D catch up. The Savage3D is its salvation. But will it be yours?

And I would care because...?

If you're interested in finding out why the ViRGE chipset hasn't yet met with the Grim Reaper, of if you want to learn why Banshee will be the bane of 3Dfx's existence, or discover how S3 plans to climb back up the ladder of success, after falling down a rung or two thanks to such industry players as ATI and nVidia.

Maximum PC Where did the name Savage3D come from?

Holdt Our view is that the engineers developed the product, and although the engineers get involved, it's fundamentally our marketing and communications groups that selects the name. We wanted to set a "take no prisoners" attitude. Our intent was to conjure up a notion of a tough, competing product that won't lose.

MPC So can Savage3D compete?

Holdt I certainly believe it can. From the data we've seen so far, it's the highest performing product out there. It certainly has the most cost-effective bill of materials for an 8MB solution that we're aware of. We know we have a considerable way to go in coaxing additional performance out of this product, but we feel it's going to be the most competitive product in the 8MB space. As for any products coming into the 16MB space, we think we'll have the most compelling offering, as well.

MPC Is the 8MB memory limit some sort of handicap...?

Holdt [interrupts] No. No. There's a notion out there that "big is always better." That's the American way I guess [laughs], but in fact, big is also much more expensive. And there's a lot of thud created in the marketplace relative to 16MB frame buffers—that they're an absolute necessity. The truth of the matter is they're not.

We're in an AGP world now. You no longer need to store all textures in the frame buffer. You can store textures in system memory and bring them across the AGP bus very effectively. Secondly, the notion of 16MB only really has applicability if you're talking about a frame buffer to service an extremely large, high-resolution monitor—such as 1600x1200. Nineteen-inch monitors are probably in excess of $1,000 today, and that's less than 3% of the market. So for those who need 16MB to satisfy that very small niche of the market, we say, "fine... go get yourself a 16MB part." But for the 97% of the world that wants the highest performance in 8MB, this product is the way to go.

The other thing we offer—and nobody else has—is the S3 texture compression (S3TC) technology. And if you look at our texture compression ratio of 6:1, then the amount of actual effective frame buffer space available to the Savage3D chip is really far more than a 16MB frame buffer could ever offer a system. So for people who don't investigate these things, the perception is 16MB must be better. But once you strip all that back, you realize the performance is no better, the cost is worse, and the actual amount of frame buffer available to textures in a texture compression environment (like the Savage3D) is much bigger.

MPC Perhaps the buffer limitation is not a technical liability, but what impact is it as a marketing liability? How can an 8MB Savage3D card compete against a 16MB card on the retail shelf?

Holdt I admit that's a tough one. In one sense, we rely on people being knowledgeable about the products they're buying. But you're right. If you just slap a number on a box, people don't know any better. There are a lot of different numbers that can be batted around, and ultimately we need to clarify and crystallize reality as much as we can for the end user. They're liable to shell out the additional dollars without recognizing it doesn't buy them anything in terms of performance. We need to convey this message to everybody who will listen.

It's not just in S3's best interests, but in reality the industry wins if users ultimately get the best product they can for their dollars.

MPC Microsoft licensed S3's compression technology for DirectX 6.0. What makes your scheme so special?

Holdt Ease of use. It can be done on the fly,

52 ▶

Coming

CEO Terry Holdt is coming back to resurrect 3D's former king-of kings

PHOTOGRAPHY BY MARK MADEO

transparent to the user. And its 6:1 compression ratio frees up additional memory for the OS and application software, such as DirectX.

MPC But isn't there always an inherent danger of visual quality degradation whenever you talk about compression?

Holdt We don't see that at all, compared to competing products. In addition to texture compression, we also have larger texture sizes. A typical texture size is 64x64, but we allow developers to go up to 256x256. In itself this gives you a higher image quality and plays more and more into the very large texturing being done in some of the newest software—primarily games—coming out. This will be a huge advantage.

MPC Will developers actually take advantage of these higher textures?

Holdt Obviously, they'll embrace it because it provides a higher-quality imaging system for them. And it'll happen within the next year. The adoption rate in this industry for new features is pretty fast. Our customer base in the gaming community is a very sophisticated organization of people who adopt emerging technologies very quickly.

MPC What were your original performance vectors for Savage3D?

Holdt Back then, we realized the ever-increasing level of texture detail would quickly blow games out of the frame buffer and into AGP system memory, leaving AGP texturing rates as the limiting factor for framerates. We knew trilinear filtering would replace bilinear filtering as the image-quality standard for next-generation games. And we saw the need to address monitor resolutions such as 1024x768. With these things in mind, we set the performance bar for Savage3D at 125MPixels/sec sustained fill rate with trilinear filtering on, while moving large amounts of textures across AGP.

MPC What features were drastically changed, dropped, or added before the spec was finalized?

Holdt From the start, the 3D feature set remained relatively constant, with most of the changes coming on the video side. TV-out and DVD decode support were added in the final hours. With Microsoft pushing video capabilities such as WebTV for Windows and PC OEMs seeing a faster-than-expected adoption of DVD-ROM drives in PCs, it became apparent that these capabilities were "must-haves" for next-generation consumer PCs.

MPC Why wasn't full bump mapping and multitexture in a single pass implemented? And do you think this will this become a liability with DirectX 6.0?

Holdt The release of DirectX 6.0 with TriTech-style bump mapping and multitexture support definitely led to lots of internal discussion, but, in the end, we decided getting product to market was far more important than having every single DX6 feature implemented in hardware.

Bump mapping seems to be a red herring. No one's excited about using it, and very few people lined up to implement the TriTech bump-mapping technology in this round of products. In fact, you could argue that if Microsoft knew TriTech wouldn't be able to deliver bump-mapping hardware ultimately, they wouldn't have included the support in DX6. Microsoft's policy seems to be adding only features there's hardware support for.

As for multitexturing, Savage3D's sustained fill rates give it very good *Quake II* numbers compared with Voodoo². If you add in 4x to 6x texture compression, detailed texture sets, and 1024x768 resolution, Savage3D brings Voodoo² to it's knees. And, if you move to AGP texturing, neither Voodoo² nor Banshee even play in this space.

Obviously we are watching DX7 closely, and our future products will be even better aligned with these releases.

MPC Are you targeting any nontraditional PC platforms, such as arcades, set-top boxes, or console machines?

Holdt [sighs] No, strictly PC. Those are definitely emerging markets, and downstream they're going to be significant, but as you know S3 is in a regrouping mode. A big mistake right now would be for us to jump into too broad a range of markets. If you serve the PC marketplace, and serve it well, you can do quite well in this business. But if you wander too far adrift, you end up not serving anyone really effectively.

Our goal is to serve the PC marketplace. Effectively.

MPC S3 is regrouping. Do you feel S3 has failed to serve the PC marketplace?

Holdt Absolutely. In the last two years, we weren't there with the high-end product the market had every right to expect from us. And in that sense, we let down some of our customers. From the time we brought out our first products way back in 1992, customers expected S3 to be there at every turn of generation with the next leading-edge product. We grew only because we met those expectations. We were the first company to bring out 16-bit and 32-bit acceleration under Windows. We drove the transition from VRAM to DRAM. And unknown to many gamers out there, the ViRGE was actually the first 3D chip in the marketplace, although today it clearly cannot be viewed in a class of 3D gaming leadership.

MPC You acknowledge that the ViRGE was a substandard product?

Holdt No, not at all! When ViRGE came out, it was the leading 3D product in the industry. This is a product that's viewed as substandard today, but over the last three years has probably sold in excess of $500 million. That's somewhere between 40 and 50 million chips! There's no higher installed rate of any graphics accelerator in the world, I'd venture to say.

MPC Impressive numbers for sure, but how many of those chips are people actually still using?

Holdt Systems are rendered obsolete pretty fast, so I wouldn't know. But yes, by today's standards, a two-and-a-half-year-old chip is substandard. But let's not measure that product by today's standard. Let's measure it on where it was when it was first introduced.

The future of S3 hinges on how well we bring out leadership products by today's standards.

MPC What about consumers who feel they've been burned in the past by S3?

Holdt Burned?

MPC Right. The ones who lost all faith and trust in the company after the ViRGE 3D debacle.

Holdt Gee, I would hope nobody feels that way. We've certainly never marketed our products or claimed that they were something they were not. In the early days of ViRGE, it was the leadership 3D product. A couple of years later there were obviously products that had higher 3D performance, but I would be surprised if there was a perception out there that S3 somehow burned them. We may have disappointed the consumer, because we weren't there with that next-generation chip, which they had every right, based on experience, to expect we were

"The tone we wanted to set [with the Sa

Holdt We're still selling ViRGE/DX chips, primarily in the Far East. It's still a reasonable product for entry-level machines.

MPC How much of the ViRGE has been carried over to the Savage3D?

Holdt None. It's a whole new architecture.

MPC Would you consider the Savage3D more of a Fred Savage type of card, or a Randy "Macho Man" Savage type of card?

Holdt [laughs] I'd like to say it has emerged from the wonder years of S3, and feel it could be a contender for the world title.

MPC When was the Savage3D originally slated and why was it late?

Holdt We put together a team of designers and architects who started fleshing out the specs in terms of fill rates and targeting performance, and we did the engine architecture, algorithms, and micro-coding and development back in the middle of 1996. We originally targeted that product to come out in the third quarter of last year. It clearly took longer to get through than it should have. So far, we're about nine months late. We think Savage3D is a leadership product now, but think what we could've had if it had come out on time!

It's changed some since its very early inception days, but the fundamental engine architecture was defined back in that time-

Sav[e]3D] was a 'take no prisoners' attitude."

going to deliver. We may have disappointed them—we certainly disappointed ourselves—but there were other alternatives to turn to.

For all those consumers who feel burned, obviously all of us here in the company feel bad about that. And to some extent, they're right: They should have expected more from us than they got.

MPC Let's face facts: S3 touted the ViRGE as a leading product for more than two years.

Holdt Our mistake was that we didn't follow up the ViRGE with a next-generation engine architecture. What we did, and I take full responsibility, was that we implemented a strategy that had worked for all our prior graphics products. We followed up our DRAM-based product with basically the same engine, but with a video RAM frame buffer instead. This dual-port memory provided higher performance, so we followed that same strategy with the ViRGE/VX—basically the same engine, but with higher memory. What we didn't see happening was that video RAM had basically lost its performance edge. Major innovations were occurring beyond EDO. Frankly, we stuck with video RAM one generation too long. And because we didn't move quickly enough, we clearly opened the door for others.

MPC And is that door now closed?

Holdt For us? No! This company still has immense strengths that many of our competitors don't have. We've got a strong central engineering organization that allows us to bring out new products quite quickly and we have a semiconductor knowledge base that is second to none in the industry. The fact that we missed that generation hurts—there's no doubt about it—but it's certainly not the last round of the fight by any means.

MPC So then... is ViRGE officially dead right now?

Holdt Nope. ViRGE and its derivative products will continue to sell in the low-end though the end of this year, and maybe a little bit beyond.

MPC Really?

frame. From third quarter of last year to the time it came out, the targeted specifications never changed at all.

MPC Did the delays affect the entire company?

Holdt You could imagine how devastating it has been for a lot of the employees of S3, particularly the engineers and architects, who saw the criticisms of S3 as being "they don't know anything about 3D." But they knew a leadership product was being implemented and was going to take two years, but hadn't come out yet. We were taking some very heavy hits by a lot of the pundits in the business who said "S3 was out of the game," when in fact we had a winning product all along.

It just wasn't out yet.

MPC Can you ever regain the top spot again?

Holdt Yes. I could be wrong here, but I don't think anybody is close to us in terms of sheer volume. And by the second half of next year, we'll be strongly positioned again.

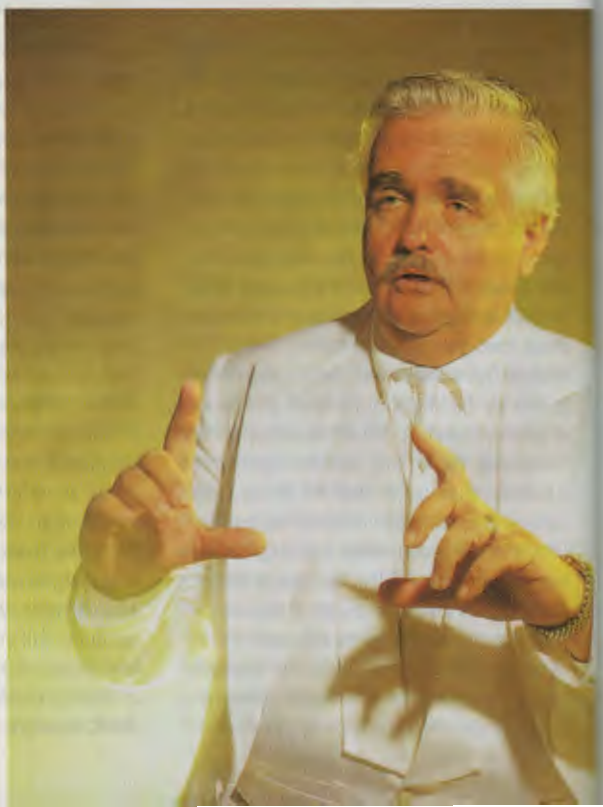
MPC Well then, how far has S3

dropped from number one?
Holdt I believe to number two. If it has not done so yet, ATI will shortly surpass us in terms of the sheer number of unit accelerators shipped in the marketplace.
MPC Who do you consider your main competition right now?
Holdt For mainstream? It's definitely ATI. We allowed ATI into this marketplace when we didn't have AGP and they did. They took advantage of that and executed very well. In terms of high-end, it's probably nVidia.
MPC What do you think of nVidia's new TNT4 card?
Holdt Haven't seen it. We hear about it. It sounds like it will be a very viable product for that 16MB space it's targeting. But I don't think it will be a cost-effective solution at 8MB from a performance-per-dollar standpoint for the user. But for those with large, high-end monitors, it'll probably be a viable product for them. I just don't think it's for the mainstream consumer.
MPC By mainstream, do you mean add-in cards or motherboard integrations?
Holdt Both. You don't need 16MB to go after those markets. And with texture compression, 8MB is all you really need.
MPC Is Matrox on your radar?
Holdt It is. We just don't talk a lot about it! Matrox has done a fairly reasonable job of executing, but we'll have to see what kind of an impact it'll make, if any.
MPC So you don't consider 3Dfx a true competitor?
Holdt Well, it's done a remarkable job establishing its position in the gaming community, especially with Glide and the good performance from both the Voodoo and Voodoo². But it's not clear that Banshee is the answer people are looking for. The jury is out on that, and it's just not clear how long Glide will carry the company before DirectX 6.0 and DirectX 7.0 allow users similar performance.

We certainly see 3Dfx as a continuing contender on the 3D gaming side, but S3 certainly paid a dear price for not having the right level of AGP when the industry wanted it, and I expect that 3Dfx will pay a similar dear price for 1x AGP on Banshee.

MPC Do you think Banshee is a step backward for 3Dfx? What would you have done differently?
Holdt I would've assured myself that my bus structure to the texture memory was more powerful than 1x AGP. Obviously 3Dfx is getting a lot of leverage from Banshee's 2D performance, which is now more of an issue than 3D performance. That alone tells me 3Dfx may not be clear it's made a big step in 3D performance relative to Voodoo².
MPC Can 3Dfx be credited for permanently changing the 3D landscape?
Holdt For bringing very high-quality arcade gaming to the PC? Sure. I think it clearly made strides with its product that we were unable to make with our several generations of ViRGE. There are always companies that move the industry forward. I think 3Dfx did that in the early days of gaming, but it's not clear that baton is going to be held by them too much longer.
MPC Just how much longer does 3Dfx have?
Holdt The question is "how much longer can Glide hold on as a proprietary API?" It will certainly give out next year, but can it even hold out throughout the Christmas season this year? I don't know the answer to that. The gaming enthusiasts will have to decide that. Right now, Glide is 3Dfx's greatest leverage, not its hardware. There are other products—including Savage3D—that are going to have as good performance, if not better.
MPC 3Dfx and PowerVR have each accused the other of buying software support for their proprietary APIs. But your predecessor, Gary Johnson, once said "S3 doesn't have to spend money to woo developers" and that "the company can spend money on other things." Does this still hold true?
Holdt I think the issue is not "can" but "should" the company be spending its money on developers. We certainly want to make sure we're in developers' minds in the context of making sure they know what Savage3D is all about. But at the same time, we have to make sure we're putting our dollars into hardware development. Because ultimately, what wins the battle is solid, high-performing chips. By far, the bulk of our dollars continue to go into that arena because that's really the only thing that can make a difference.
MPC Some companies charge that the Savage3D can't be a contender due to its high price. Is the price too high?
Holdt One shouldn't assume that $35 (in lots of 10,000) renders a product noncompetitive in a mainstream marketplace. If you're $10 higher than that, you're pushed into the ozone layer. But S3's structure and cost is among the strongest in the industry. I believe there isn't a company in the business that can produce it more cost-effectively than S3. One

"The gaming community is a very sophisticated organization of people who adopt new emerging technologies very quickly."



shouldn't necessarily confuse cost with price.

MPC What about criticism that the Savage3D is silicon heavy?

Holdt While Savage3D weighs in at more than 5 million transistors, S3's manufacturing strengths are more than adequate to ensure that this will be a volume product.

MPC Is it possible for S3 to develop a single chip that can outperform dual-SLI Voodoo²s?

Holdt [pauses] Is it possible? Yes.

MPC Is it probable?

Holdt No comment on that.

MPC Can we explore that a little? "No comment" sounds like you can't do it. Is this the answer you really want to give?

Holdt The technical feasibility of such a production is not the limiter. It's more of an issue of should the company be putting its most critical resources and architecture and development and engineering talent to attack that part of the marketplace. It's certainly a viable part of the marketplace. We recognize the heavy hitters and game developers who attain that level, but for us it's a trade-off. We need to look at how large that particular part of the market is, versus the resources it takes to accomplish that task.

[grinning] That's my "no comment!"

MPC Is Voodoo² the be-all-end-all of 3D accelerators?

Holdt Oh no. That implies there's no place else to go in 3D. If you believe in the notion of suspended disbelief and the implementation of 3D through very high-quality transforms and lighting, and all the other technologies that drive 3D, it's an almost insatiable demand for transistors. Look at the CPU marketplace and the communication markets and you can envision a reasonable limit for CPU transistors. In a few years, a CPU with x million transistors should be enough to satisfy the demands of say, the communications pipe, perhaps video (in terms of fps), AC3 audio, and so forth. 3D is completely different. 3D's an issue of "how good is good?" It's no longer measured by the bandwidth of a broadband link or the number of frames you can coax out of a video. It's determined by the proven experience in terms of gauging an event and relating it to reality. In that context, the quest for transistors is going to go on for years. It's probably the most identifiable technology arena where it's not clear where the end is going to be with transistor counts.

Even today, 3D chips produced by S3 and others are achieving transistor counts that are at, or exceeding, the CPUs. Five years ago that was unheard of—the CPU was clearly the dominant force in the PC, and everybody else was relegated to tens of thousands of gates. Literally, in the course of two years, the demand for high-quality imaging in the 3D environment has driven that one segment of the PC right past the CPU in terms of complexity.

MPC Yet 3D cards don't earn the respect that CPUs have.

Holdt There's certainly no shortage of frustration to those of us in the graphics industry who are producing the most complex devices in the business, only to have them relegated to a cost point so dramatically below that of CPUs. It's the 3D imaging devices that deliver the differential benefit of one system to another. It is responsible, more than any segment of the PC, for the user experience. And because there are so many of us in the business, it's driven the value of that segment of the PC to almost commodity-like numbers.

Which is great for consumers mind you. But it's a tough environment for somebody in the graphics arena.

MPC What features have yet to be conquered in 3D?

Holdt High-quality lighting and transform capabilities. Possibly higher levels of fill rates. Not fill rates per se, but higher-quality imaging. However we get there. Through fill rates or through increasing the bandwidth across the bus to move textures to the imaging stream itself, and I suspect there are a million other issues our architects worry about every day.

MPC Does S3 spend a lot of resources developing pseudo-GL drivers for games?

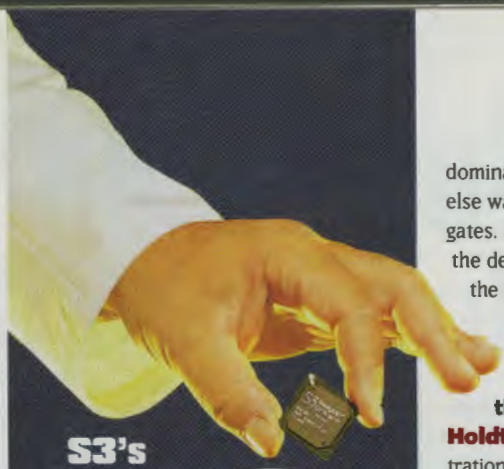
Holdt We allocate a fair bit. We'll have a full OpenGL ICD for Savage3D. There are a number of games that run with OpenGL, and obviously *Quake* is something we have to support.

MPC How important, realistically, is full OpenGL support?

Holdt A number of years ago, it was relegated more to pure workstation environments and wasn't a particularly large factor for us. But at this point in time, there's clearly a market for high-end OpenGL products. Products such as 3DLabs Glint have managed to carve out a pretty decent niche in the high-end marketplace, but how long they will continue to be a factor is hard to judge.

MPC In terms of software drivers, who should be responsible for them: you, the OEM, or Microsoft?

Holdt If it's a product developed by S3, then we're ultimately responsible for it. But if I hand those drivers off to someone who modifies that code in a way that I'm not



S3's 10 COMMANDMENTS

Thou shall value the sanctity of intellectual property—thine own, and that of others

Thou shall hear the customer, and listen to the customer

Thou shall only promise that which thou can deliver

Thou shall surprise thy competition with innovation and execution

Thou shall not make the same mistake twice

Thou shall remember thy strength in software, manufacturing, and engineering

Thou shall not misrepresent thy performance or features to the marketplace

Thou shall make a difference—. everyday

Thou shall do things right—but more importantly, do the right things

Thou shall win with Savage3D!

aware, I may end up being pulled into the loop to figure out what's wrong. But it's hard for me to hold my people responsible for code they didn't write. Many times we get involved in the solution process, independent of whether or not we actually wrote any of the code. It may not be fair, but that's the business we're in.

MPC What did S3 gain from purchasing the Exponential patents? And how much did it cost you?

Holdt [pauses] I don't think we ever went public with the exact figure, but this I will say: We paid enough to buy them! We bought them because we felt they were a strong patent portfolio that we could potentially utilize either offensively or defensively in the future.

MPC Patents seem to be the name of the game these days. Don't you think patent battles ultimately only harm end users, especially since they generally restrict innovation and the creation of new products?

Holdt Well, innovation and creation belong to the people who own the patents. You either develop patents on your own, or you acquire patents on the open market. And they ought to be protected.

MPC Sure, but companies are choosing to battle it out in court, rather than spending that money and resources on building better products. Isn't there something inherently wrong with that?

Holdt Well, let's talk about what patents are all about. A patent, in and of itself, does not confer any necessary rights to utilize that technology on the person who holds the patent. What it does confer is the right to prohibit others from using it. People have a right to innovate, which costs money, and they have a right to protect that innovation, which also costs money. I don't see why we should treat those individuals any differently in terms of their rights to enjoy the fruits of their work and have to associate it with the end user.

All I'm saying is, if anyone is in violation of what we feel is ours, then we deserve recognition of that fact by the courts.

MPC What's your opinion of the Micron/Rendition initiative dubbed Socket X?

Holdt I think it's a very good idea if you're in the memory business. [pause] It's not a great idea if you're in the graphics business trying to establish a differentiation of your products.

It will be good for consumers if a large enough consortium is actually pulled together. One of the technical issues is, there is a limitation on frame buffer because it's all integrated DRAM. If you reach forward, there is a technology limitation where memory technology is in terms of being able to embed inside the graphics, which could ultimately be a problem on the consumer side, in terms of performance. As long as the embedded DRAM side can keep up with the overall frame-buffer demands in a single chip, there would be less of an impact on the consumer.

The biggest issue is always one of economics. If they can pull enough graphics vendors on to the Socket X bandwagon, it could be a positive. But it's going to be very difficult to line up a bunch of rodeo riders in the graphics business, corral them all, and move them all in one direction. There's a tremendous feud that all of us can do better than the next guy, and standardization brings a certain degree of leveling the playing field. Most people, particularly aggressive people, aren't likely to want to give up their edge. It's going to be a severely uphill battle.

MPC Has S3 been approached to join the Socket X consortium?

Holdt Yes, but no decision has been made.

MPC The Savage3D is the first product in a whole new roadmap for S3. Can you give us a peek into the future a little bit?

Holdt I could, but I would prefer not to.

MPC Why's that?

Holdt When we were the leader, we had the largest engineer head count in the San Francisco Bay Area in graphics, we tended to be a supplier of engineers to a number of other people in the industry. And there is not necessarily an attendant level of confidentiality held by everyone when they transition from one company to another, so we try to retain as much confidentiality as we can. It's difficult enough dealing with that problem, without overtly making statements about new products.

MPC Aside from Savage3D, what application or piece of hardware are you most anticipating?

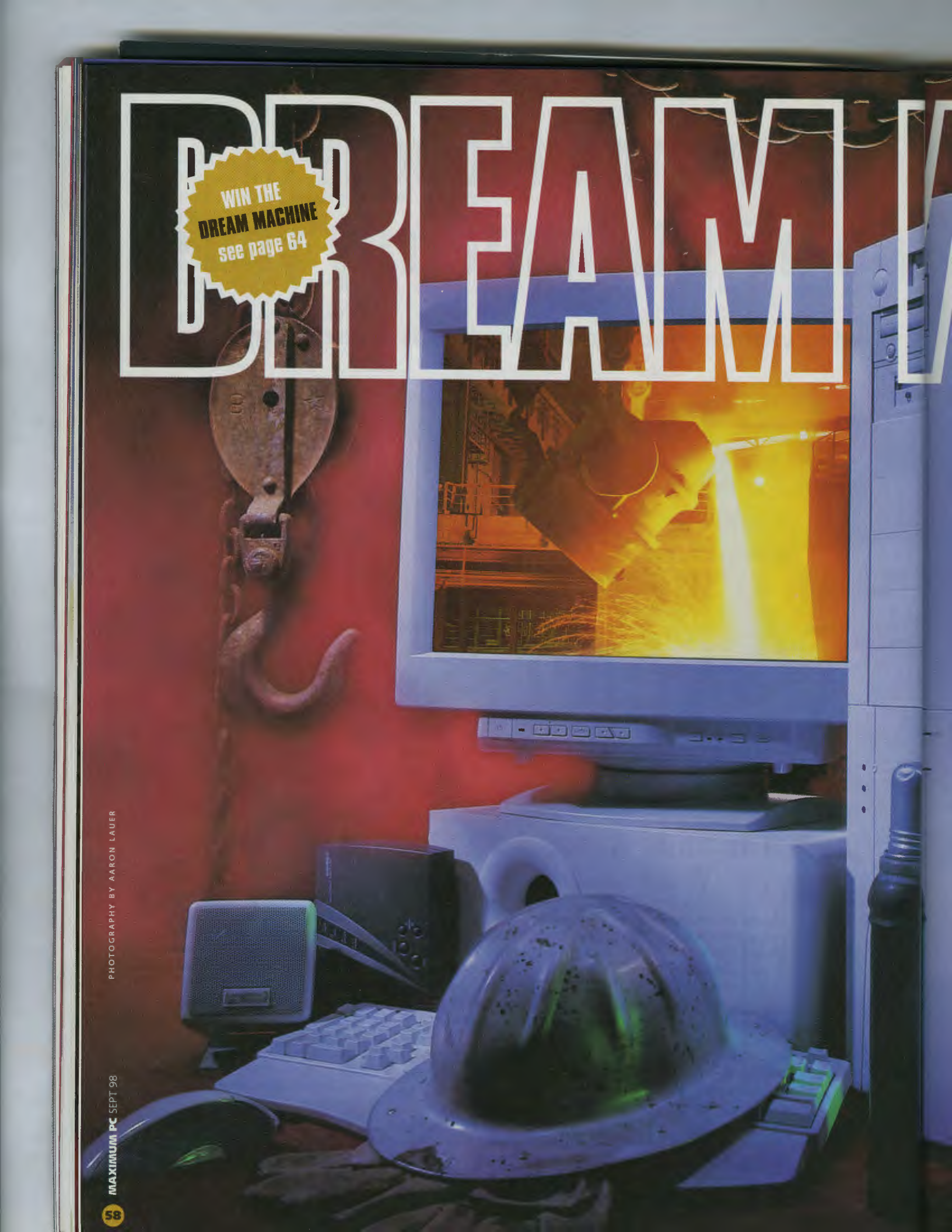
Holdt Microsoft's upcoming Chrome technology.

MPC What do you think of products such as AMD's K6-2 with 3DNow! and Intel's Katmai?

Holdt In the context of being able to enable 3D, they're good building blocks. It's one more level of capability that all of us in the graphics silicon chip development process can use to provide the user with a better experience. We welcome them.

"There's certainly no shortage of frustration to those of us in the graphics industry producing the most complex devices, only to have them relegated to a cost point below that of CPUs."

DREAM M



PHOTOGRAPHY BY AARON LAUER

MACHINE

We Hand-Pick the 17 Best Components for the Ultimate PC

Screw the "sensible" computer. Go for the best. The best CPU, the best videocard, the best hard drive. The best motherboard, the best soundcard, the best monitor.

The best individual components your hard-earned money can buy.

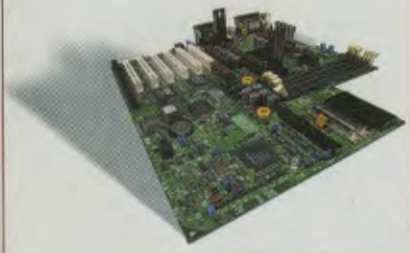
And when you put them all together, you have a dynamic, balanced, perfectly integrated system that outperforms the sum total of its individual parts. A machine built with intelligence. A machine built with passion.

Hemming and hawing over those awesome $250 speakers with the butt-rattling subwoofer? Don't sweat the details, brother. Get it all.

Get it all. Dream Machine 98, the ultimate hand-built $5,000 PC.

Our team of experts picked the best parts across 17 different component categories and assembled a machine optimized for performance and expansion. On the following pages, we describe our reasoning behind every component decision and detail how you can supercharge your own hand-built PC. For good measure, we also name the best component choices for a low-cost PC and a gaudy high-end workstation, and even pit Dream Machine 98 against the best $5,000 systems that two retail manufacturers could muster. Finally, we sticks our asses on the line by predicting some of the components for Dream Machine 99. Whether you're building a PC from scratch or simply want to upgrade a single key part, don't make a move until you're fully armed with the right information. This isn't your car we're talking about. This is your computer.

Pentium II We overclocked this 400MHz processor to 450MHz and performance increased across the board. The extra heat generated by overclocking can destroy a CPU, but we feel our case is more than adequately cooled by six fans. The jacked-up processor ran flawlessly during 48 straight hours of a looping *Quake* demo, and hasn't exhibited any instability during general testing—and we haven't shut down the machine for more than 20 minutes since we built it!



Tyan Thunder 100 Besides offering more expansion and I/O interface options than we've ever seen, this motherboard's mouse-driven BIOS (AMIBIOS 2.5) gives you control over every operation the board will ever execute. For hard-core system tweakers only (and the user's manual simply rocks).

▶ CPU

The **400MHz Pentium II** ($642, www.intel.com) is currently the fastest beast in Intel's consumer desktop arsenal and the only logical choice to drive Dream Machine 98. Based on last year's core Pentium II technology, the 400MHz sports 512K of closely coupled L2 cache running at half the CPU speed. New to the mix is a faster system bus, which speeds up information transfer between the memory and CPU from 66MHz to 100MHz. The faster bus requires newfangled 100MHz SDRAM.

The latest iteration of the P-II lacks the enhanced floating-point instructions of AMD's recently released K6-2, but its normal floating-point power is second-to-none. This translates into stellar performance for applications that rely on this type of number-crunching—*Photoshop* and 3D rendering apps such as *Lightwave*, for example. Simply put, the Pentium II is the best all-around processor, and with Intel's aggressive price cuts, you can expect it to cost about half as much toward the end of the year.

ALTERNATIVES: If we were simply looking for excellent gaming performance at a great price, we'd have gone with the 333MHz AMD K6-2 with 3DNow! technology ($369, www.amd.com). 3DNow! is a synonym for 21 special floating-point instructions that speed up the rendering process in 3D games—just as long as you have 3DNow!-optimized drivers for your 3D accelerator card, or your games are specifically coded to leverage the technology. Unfortunately, the K6-2's nonoptimized floating-point performance is dodgy, making the CPU a poor choice if you're a graphic designer, 3D modeler, or spreadsheet cruncher.

For maximum power, muscle-bound technophiles will want to wait for Intel's 450MHz Pentium II Xeon ($3,690). Packing up to 2MB of L2 cache, this workstation/server-level processor may just be the ticket to processing nirvana. Sadly, the power doesn't come cheap, and you'll need a motherboard outfitted with the 450NX or 440GX core-logic chipsets to dance with Xeon.

Simply put, the Pentium II is the best all-around CPU, and with Intel's aggressive price cuts, you can expect it to cost about half as much toward the end of the year.

▶ Motherboard

Because Dream Machine 98 uses a 400MHz Pentium II riding the 100MHz system bus, compatibility issues dictated that our motherboard be based on the Intel 440BX core-logic chipset. But after fulfilling this prereq, we had room to splurge. Deciding not to skimp on the one component that determines what a computer can and cannot do, we landed upon an ATX board that has it all: the titanic **Tyan S1836DLUAN Thunder 100** ($559, www.tyan.com).

Dual Slot 1 interfaces accept all sorts of Pentium IIs, from the 233MHz entry-level model to the 400MHz Deschutes. Four 168-pin DIMM sockets can take you to 1GB SDRAM heaven. While the board comes with Ultra DMA–compatible bus-mastered EIDE ports, we were most turned on by the built-in Adaptec AIC7895 Dual-Channel Ultra Wide SCSI chip. A lone 50-pin SCSI-2 port and dual 68-pin high-density Ultra Wide SCSI ports await all the storage loving you can throw at it.

The ATX I/O header connector houses every input and output known to man. Besides the obligatory dual-serial/single-parallel, mouse/ keyboard, and USB ports, you get a built-in 10/100BaseT Ethernet port. Also soldered to the board is a Creative Labs Vibra 16XV chip for kooks who must have 100% Sound Blaster compatibility.

Construction Tips

for Maximum Performance

If you want to learn how to build a computer from scratch, you'd do best to watch an expert in action and pick it all up through osmosis—sort of like working on that old Chevy Malibu with your dad. If this strategy is out of the question, check out **www.motherboards.org**. The link titled "How to build a PC" contains a lot of essential information, along with a list of books on the subject. And, of course, all your individual components should come with installation instructions. In lieu of taking you step-by-step through the construction process—that's for another month—here are some specific tips on how we optimized Dream Machine 98 for power, stability, and expansion.

A Machine For Every Budget

Here are the final price tallies for Dream Machine 98, also an inexpensive alternative and the obscenely powerful supercomputer we'd build if some rich guy gave us a pile of money.

Prices were culled from manufacturer-suggested street prices and quotes from reliable retail vendors. You should be able to find even better pricing by checking out **www.pricewatch.com**.

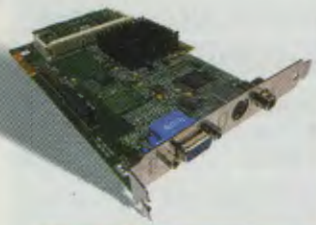
Component	Budget Gourmet	Dream Machine	Conspicuous Consumer
CPU	AMD 333MHz K6-2 with 3DNow! **$369**	Intel 400MHz Pentium II **$642**	Intel 450MHz Xeon **$3,690**
Motherboard	FIC PA-2013 **$130**	Tyan S1836DLUAN Thunder **$559**	Tyan S1836DLUAN Thunder **$559**
Memory	64MB SDRAM DIMM **$85**	128MB SDRAM DIMM **$179**	4 256MB SDRAM DIMMs **$3,100**
Videocards	Matrox Mystique G200 16MB **$189**	Matrox Mystique G200 16MB **$189**; Canopus Pure 3D II 12MB **$329**	Matrox Millennium G200 16MB **$228**; Dual Canopus Pure 3D II 12MB **$658**
Soundcard	Creative Labs Vibra 16XV (on motherboard) **$0**	Turtle Beach Montego A3DXstream **$130**	Event Electronics Gina **$500**
Hard Drive	10.1GB IBM DeskStar 14GXP **$350**	9GB Seagate Cheetah Ultra Wide **$790**	Dual 9GB Seagate Cheetah Ultra Wide **$1,580**; Adaptec ARO-1130CA **$260**
CD-ROM	Toshiba XM-6202B 32x **$129**	HiVal 40x40 **$200**	HiVal 40x40 **$200**
Removable Storage	Iomega Zip **$75**	Iomega Zip **$75**	Iomega Zip **$75**; Iomega Jaz 2 **$450**; Plextor PlexWriter CD-R **$380**
Floppy	Tin of kippers **$5**	Alps Floppy Drive **$18**	LS-120 **$90**
Modem	Asonic 56K **$34**	3Com U.S. Robotics 56K **$200**	3Com U.S. Robotics 56K **$200**
Monitor	Any 19-inch Hitachi-based monitor **$600**	Sony GDM-400PS **$900**	Sony GDM-F500 **$1,900**
Speakers	Altec Lansing ACS-48 **$79**	Cambridge SoundWorks MicroWorks **$249**	Cambridge SoundWorks MicroWorks **$249**; Cambridge SoundWorks PSW1 subwoofer **$700**
Keyboard	flea market special **$5**	Microsoft Natural Keyboard Elite **$65**	Cherry G81-8004 **$85**
Mouse	CompUSA special **$1**	Logitech MouseMan+ **$41**	Logitech MouseMan+ **$41**; Microsoft SideWinder Force Feedback Pro **$122**
Case	CompuDEX IW-Q500 **$130**	Addtronics 7890A **$198**	Addtronics 7890A **$198**
OS	Linux **$0**	Windows 98 **$170**	Windows 98 **$170**
TOTAL	**$2,181**	**$4,934**	**$15,435**

1 Mounting your Motherboard

Ensure your motherboard is securely mounted to the case (or, in our example, removable bracket) and not in contact with any bare metal, lest you short the poor thing out. If your case has nylon spacers to help seat the board, use them. Also, make sure your mounting screws have those tiny cardboard ringlets that keep bare metal screws from touching the motherboard. Finally, if you don't align the motherboard just right when you mount it, your expansion cards won't line up properly with the grill on the back panel.

ILLUSTRATIONS BY FRITZ STRIKER

128MB SDRAM Our humble DIMM isn't officially sanctioned by Tyan, but costs less than "approved" memory and works just fine, thank you.



Mystique G200 Matrox's new vidcard offers superlative 2D acceleration and enough 3D power for all but the most demanding games.

Pure 3D II This add-in 3D accelerator from Canopus is the best implementation of 3Dfx's state-of-the-art Voodoo^2 chipset. Dig the fan for overclocking madness!

The S1836DLUAN offers six PCI slots, along with one AGP slot and a lone shared ISA slot. While server-level motherboards that offer a similar bounty of slottage can be had, this particular Tyan board is the only consumer product that offers more than five PCI slots. Once you see all the add-in cards we picked for Dream Machine 98, you'll see why we needed so many cots in the barracks.

ALTERNATIVES: The Tyan S1836DLUAN is about as close to motherboard perfection as you'll find; perfectly suited for both a $5,000 system and a $50,000 system. However, if you crave not onboard SCSI or that fancy sixth PCI slot, the Micronics Helios ($269, www.micronics.com) is a sweet alternative. This board is similar to the Tyan board, but comes with five PCI slots, no SCSI, and an ESS Maestro-2 PCI sound chipset instead of the Creative Labs Vibra.

If you decide on going the Socket 7 route with the AMD K6-2 processor, take a peek at FIC's PA-2013 ($130, www.fic.com.tw). Based on the VIA MVP3 core-logic chipset and armed with 1MB of L2 cache, a 100MHz system bus, and the promise of full AGP 2x compliance, it's an ideal match for the K6-2 CPU.

▶ Memory

Selecting memory used to be easy: Buy some generic module at the corner computer store and pop it in. But with the advent of the tight PC100 SDRAM spec, motherboard manufacturers recommend that you buy only "approved" memory to avoid problems. Thanks, but no. At more than $400 for an approved 128MB DIMM, we decided to buy 128MB of generic SDRAM from Central Computing ($179, www.centralcomputer.com). Dream Machine 98 runs just fine with the renegade RAM, and we're just smitten with the cost savings. We decided against ECC RAM partially to avoid the slight performance hit and because of the high quality of today's RAM, which rarely incurs errors.

ALTERNATIVES: You can easily shave about $100 off the price of your machine by buying just a 64MB DIMM. On the high end, you could pay up to $3,100 for four 256MB ECC SDRAM modules from Cosair Memory (www.cosairmicro.com) in order to get Dream Machine 98 to its 1GB memory limit. The Cosair SDRAM is approved by Tyan, and if you're going to pack this much memory on a board, you might as well play it safe.

▶ Videocards

For no-apologies video performance, we split duties between two Kick Ass add-in cards. The **Matrox Mystique G200 16MB** ($189, www.matrox.com) delivers flicker-free, high-res 2D acceleration, while the **Canopus Pure 3D II 12MB** ($329, www.canopuscorp.com) is the best 3D accelerator currently available.

Based on Matrox's own proprietary MGA-G200 chipset, the Mystique's 16MB SDRAM and 230MHz RAMDAC deliver a maximum resolution of 1920x1200 at 70Hz. 1600x1200 refreshes at 85Hz, while other resolutions can be had at rates up to 200Hz. Res 'n' refresh aside, the Mystique packs twin 64-bit buses operating in parallel to accelerate 2D performance like Matrox has never done before.

The 128-bit DualBus also does wonders for this AGP 2x part's 3D acceleration. We'd have never have predicted it six months ago, but Matrox now delivers 3D performance that approaches the likes of 3Dfx. The Mystique can crank up 24-bit Z-buffered gameplay at 1024x768. Throw in TV-out, full-screen anti-aliasing, and 3D display in full 32-bit color, and you've got one bad mutha. And besides DirectX/Direct3D support, a full OpenGL ICD delivers acceleration in 3D rendering apps. Yes, this card is a workstation dream.

Glide support, you ask? We couldn't resist. Last-minute price drops allowed us to whittle down the total price of Dream Machine 98 to accommodate the Canopus card, which we consider to be the best implementation of the 3Dfx Voodoo^2 chipset. And, yes, the Pure 3D II is a faster 3D accelerator than the Mystique, which we chose for its 2D power and versatility.

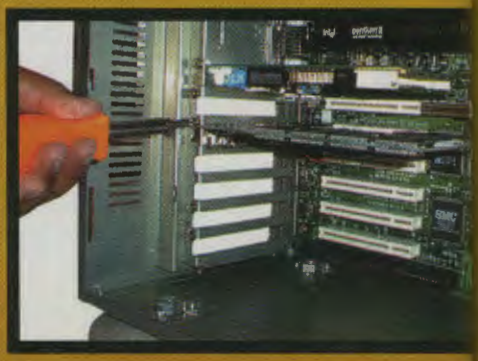
Armed with 12MB of 100MHz EDO

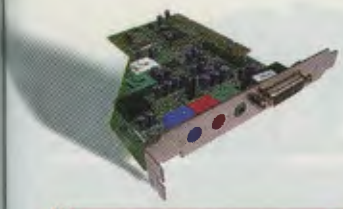
2 Seat your expansion cards properly

Do you stare at a blank monitor after flipping your power switch? Does your motherboard beep at you like a scolding mother? A lot of problems can be traced to improper expansion card seating. AGP cards sit a bit deeper than PCI cards, so make sure yours is firmly inserted. And be careful when you screw down any card: The physical act of screwing can pop the card ever-so-slightly out of the slot.

3 Keep the RAID port free

All those open PCI slots look mighty inviting, but you'll want to leave a special one free for future expansion. The PCI slot directly below the AGP slot has the extended connector that's required for installing a RAID controller. Leave this slot open, lest you're forced to shuffle your cards at a later date.





Montego A3DXstream
Supporting both A3D and DirectSound3D, this PCI sound card is perfect for games that boast 3D positional sound. Digital ports turn the card into a desktop recording studio.

Cheetah Ultra Wide
Seagate's 9GB hard drive spins at 10,000RPM and rides the Ultra Wide SCSI bus. Put the speedy spindle and fat pipe together, and you've got throughput to write home about. Remember, a drive like this needs the appropriate Ultra Wide SCSI controller. Luckily, Ultra Wide SCSI support came stock on the Tyan motherboard.

DRAM, nothing about the Pure 3D II is ordinary. Canopus shaved an inch from 3Dfx's Voodoo² board reference design (making the card a better fit for AT motherboards) and added an integrated fan on top of the card's pixelFX2 chip for extra cooling action (feel free to overclock the card to 100MHz without incurring a meltdown). Throw in S-Video/composite outputs for TV action, and you can play your favorite games on the boob tube at 800x600. Finally, creme-de-la-creme video drivers, which grant you absolute control over all Voodoo² functionality, are the frosting on this delectable polygon pastry.

ALTERNATIVES: The ultimate videocard array consists of two Canopus Pure 3D II boards running in SLI mode, along with Matrox's Millennium G200 16MB ($228). The Millennium is armed with a 250MHz RAMDAC, uses faster SGRAM instead of SDRAM, and refreshes at 76Hz at 1920x1200. If you want to save some jingle and go the one-card route, buy the Mystique G200. Its 3D firepower won't let you down.

Modern soundcards ride the PCI bus, which lightens the processing load of the CPU and allows it to do more of what it does best: crunch polygons for faster framerates in 3D games.

▶ Soundcard

It wouldn't be Dream Machine 98 if it contained an old-school ISA soundcard. Modern soundcards ride the PCI bus, which lightens the processing load of the CPU and allows it to do more of what it does best: crunch polygons for faster framerates in 3D games. We decided to go with the Aureal Vortex-based **Turtle Beach Montego A3DXstream** ($130, www.tbeach.com).

With a signal-to-noise ratio of >92dB, the Montego is library quiet, supports A3D, DirectSound, and DirectSound3D for all types of gaming madness, and streams up to 64 voices from a 4MB patch set stored in system memory (the MIDI samples are top-grade for a consumer gaming card). An optional S/PDIF port is good news for folks who want to record and play digital audio at up to 48Hz sample rates. And you have to love the daughterboard interface for attaching an external MIDI device. The Montego offers legacy support for DOS and Sound Blaster compatibility, but since this takes up two IRQs, we mapped the secondary IRQ to the first and said to hell with Sound Blaster emulation.

ALTERNATIVES: If you don't care about 3D sound or are simply a tight-wad, stick with the Creative Labs Vibra 16XV that's soldered to Dream Machine 98's motherboard. If you're serious about audio recording, multiple I/O is the key, and you should check out the Event Electronics Gina ($500, www.event1.com). Two input and eight output channels give you 20-bit, 128x oversampling via quarter-inch jacks. S/PDIF I/O gives you up to 24-bit audio quality. Line quality is excellent at a >98dB signal-to-noise ratio. Like almost all high-end audio solutions, the Gina is devoid of any synth engine.

▶ Hard Drive

Like the motherboard, the hard drive is too important a component to skimp on quality. Its I/O interface and spindle speed dictate read and write times, which affect overall performance when your system runs out of memory and begins using your hard drive as a swap disk. That said, a 10,000RPM drive was in order, and we wanted an Ultra Wide SCSI

4 Stagger your drives

Why pack drives together when you can distribute them in every other bay for better air flow? Staggering devices keeps them cooler, and our five fans deliver a whole lotta cool. And while we're talking about drives: We only have two ATAPI IDE devices, so we made them both masters on their own buses. The CD-ROM drive is a master on the primary bus and the Zip drive is a master on the secondary bus. Since only one device on a bus can be read or written to at a time (an IDE limitation), it helps to keep them separated for better multitasking madness.

5 Overclock the CPU

Overclocking generates excessive heat and can destroy your CPU if it's not sufficiently cooled, so tread carefully into the dark arts—overclocking *isn't* covered by warranties. That said, with some 440BX motherboards, you can increase your CPU's core speed by raising the system-bus speed via a BIOS tweak. We were able to boost our 400MHz CPU to 452MHz by increasing our bus speed from 100MHz to 113MHz. (The faster speed is defined by the product of 113MHz and the 4.0 multiplier. Go to **www.maximumpcmag.com** for the full story on overclocking.)

HiVal 40x40 This CD-ROM drive, which uses Zen Research's TrueX technology, promises 40x performance. But wouldn't you know it, when we benchmarked the drive, it rated 45x. Whoah! No complaints here, Chester. We'll take the extra speed and owe you 5x.

Take Home the Dream Machine

Do you feel the need? The need for ultimate PC speed? Do you need 450MHz of P-II, 10,000RPM hard drive spin, true 45x CD-ROM, and 67W amplified sound? Then you need to the Dream Machine 98. And the only way to get *the* actual Dream Machine 98 is by entering our online contest at www.maximumpcmag.com. Log on for details today.

device to go with the dual-channel Ultra Wide SCSI adapter that comes stock with our motherboard. Say hello to the 9GB Seagate Cheetah Ultra Wide ($790, www.seagate.com), the fastest drive ever to grace the lab.

With a 10,000RPM spindle speed, 12.6MB/sec peak read throughput, a random access seek of 8.5ms, and 1MB of cache, the Cheetah is guaranteed to set new land speed records. Its SCSI architecture also takes the burden off the CPU, demanding only about 7% of its attention. We could have saved money by going with a 4GB version of the drive, but decided this capacity was too small for the sundry duties our versatile machine would be tackling.

ALTERNATIVES: Save a few bucks with the 10.1GB IBM DeskStar 14GXP ($350, www.storage.ibm.com). It spins at 7,200RPM and uses the Ultra DMA interface for fast throughput. For extreme I/O mayhem, throw down for a second Seagate Cheetah and race the two jungle cats in tandem via RAID 0 data striping. Luckily, our Tyan motherboard has the requisite RAIDport II slot to pull off this little trick, but we would also need to buy the appropriate controller card—such as the Adaptec ARO-1130CA ($260, www.adaptec.com). It comes with 16MB of data cache for accelerated performance.

▶ CD-ROM

We briefly considered a DVD-ROM drive to handle both DVD multimedia content and traditional CD-ROM duties. But a lack of DVD-ROM games and the prospect of slow CD-ROM read times convinced us to go with the fastest CD-ROM drive we've ever tested, the **HiVal 40x40** ($200, www.zenresearch.com). Based on Zen Research's TrueX technology and manufactured by Kenwood, this 40x drive uses a Constant Linear Velocity (CLV) architecture. Unlike Constant Angular Velocity (CAV) drives, which reach their highest speeds only on the outer tracks of full discs, CLV drives spin at a constant rate, providing peak throughput across all points of the disk. TrueX CLV drives also read seven tracks at a time. This allows them to achieve their 40x throughput at slower spindle speeds and thus avoid the spindle vibration problems suffered by drives that have to spin much faster to reach their advertised performance spec. Fact is, our HiVal drive spins at around 3,000RPM (a speed you'll find in 6x to 10x drives), but delivers 6.7MB/sec throughput for spec-busting 45x performance.

ALTERNATIVES: There is no high-end alternative for TrueX technology. The HiVal drive costs relatively little for the best CD-ROM performance on the planet. To save a few yen, however, go with the Toshiba XM-6202B 32x ($129, www.toshiba.com). Of all the 32x

Dream Machine 98

Real-Life Apps Tell the Tale

Flip Up

If you don't think you need maximum power, you've obviously never waited nine-and-a-half minutes for an *Inspire* rendering to finish. Fact is, we wish Dream Machine 98 were even faster. We could have used more power for graphic design apps and 3D gaming. Still, our performance tweaks were a step in the right direction.

When we boosted the CPU from 400MHz to 450MHz, we shaved more than a minute off our *Inspire* test, going from 577sec to 515sec for an 11% performance increase. In our *Photoshop* test, we shaved off six seconds, going from 68sec to 62sec for a 9% increase. CPU overclocking had a much less profound affect on 3D gaming. We gained only one fps in the OpenGL test.

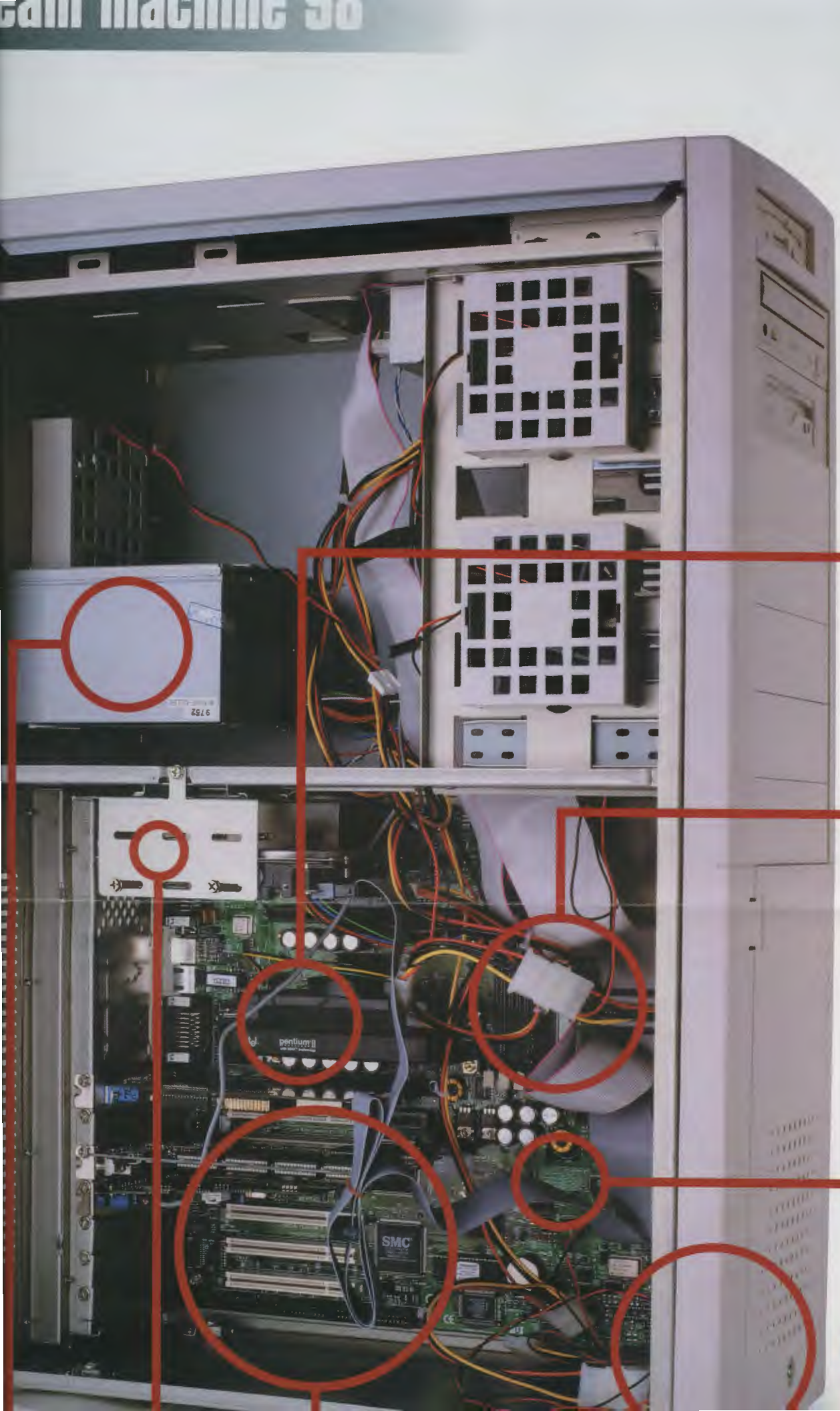
But wait! That Canopus Pure 3D II card can be overclocked, as well. When we boosted the card from its default setting of 93MHz to 100MHz, we gained another 5.3fps in the OpenGL test and landed on our official score of 58.6fps. We essentially chose the Voodoo²-powered Pure 3D II for its Glide support, but make no mistake, the Voodoo² just happens to be the fastest 3D chipset around: Dream Machine 98 scored 64fps on the Direct3D test when running off the Mystique G200. The score jumped to 98fps when running off the Pure 3D II.

Like the Pure 3D II, the Tyan Thunder 100 motherboard is a hardware hacker's dream. The BIOS offers tweaking options galore, including the system-bus slider that enables CPU overclocking. If you want to jump headlong into adventure, you can also mess with arcane minutia like the PCI Latency Timer and Graphics Aperture Size. Most folks, however, will play it safe and simply use the Thunder 100 for its superlative expansion opportunities. If you can find an ATX mobo with more PCI slots and I/O interfaces, let us know and we'll enter you in our PC Stud Boy contest.

At 400MHz, the Dream Machine hit 188 on the bootMark—about three points less than other machines equipped with 400MHz P-IIs. We credit the slight performance decrease to the immense amount of circuitry the machine has to pump data through. Of course, when we jacked the CPU up to 450MHz, we bootMarked the machine at 210.9.

We don't expect another system to cough up a faster score for quite a while.

cam machine 98



EXPANSION MAP

AGP	2D/3D Videocard
PCI/RAID	Open
PCI	3D Videocard
PCI	Soundcard
PCI	Soundcard
PCI	Soundcard
PCI/ISA	Modem

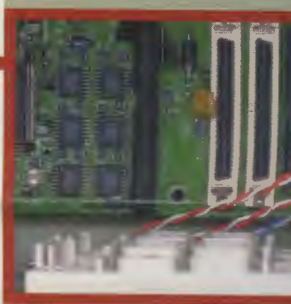
IROS

00	System timer	08	Sy
01	Keyboard	09	O
02	IRQ controller	10	PC
03	COM2	11	US
04	COM1	12	PS
05	Soundcard	13	Nu
06	Floppy port	14	ID
07	LPT1	15	ID

DMAS

01	Soundcard	05	
02	Floppy controller	06	
03	Soundcard	07	
04	DMA controller		

Wonder Twin Powers—Act
Tyan motherboard comes with two
to run a couple of CPUs in tandem
experience increased performance,
applications must support CPU inte



Eeww, It's All Scuzzy Insid
resist a mobo that comes with built
bus supports Ultra Wide, while the
both Ultra Wide and SCSI-2 (50-pi

It's Like a Nitrous Kit... But
here chart describes the jumper setti
ing your processor. Unfortunately, ou
jumper overclocking, so we had to g
increasing our system-bus speed in t

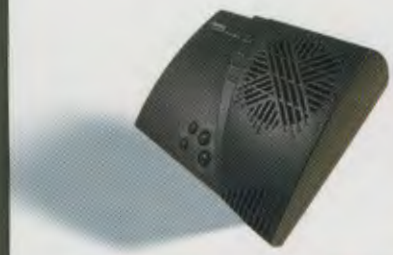
UNDER THE HOOD

THE BRAINS

CPU	Intel Pentium II 400MHz ov to 450MHz

Zip Drive It might hold only 100MB, but Iomega's Zip is the most popular removable storage drive on the planet. And that's what we're looking for: ubiquity (so we can swap discs with friends).

Alps Floppy So we decided to install a floppy. Big deal. It's not like we want a medal or anything. Soon enough, floppies will be as passe as Crystal Pepsi.



56K Voice Faxmodem Pro This dandy from 3Com is stylish, USB-ready, and comes with a high-quality speakerphone. We wanted USB, so the modem wouldn't eat up an IRQ.

Sony GDM-400PS If you want a bright, brilliant, colorful display, you need an aperture grille monitor. Sony's 19-incher is the best available in its size category.

ATAPI drives we've tested, it was the only one that didn't suffer from spindle vibration.

▶ Removable Storage

We couldn't build Dream Machine 98 without an **Iomega Zip** drive ($75, www.iomega.com). Sure, it's relatively slow and tops out at 100MB capacity, but ubiquity is the name of the game, and with millions of Zips out there, trading files via sneaker-net would be painful without this legacy drive. We reached for the internal IDE version. We could have gone for the internal SCSI version for $25 more, but decided, "Hey, it's a Zip! We're already in the sticks, so let's enjoy the grits!"

ALTERNATIVES: The Zip is the cheapest removable storage solution around, so stick with it if you're building Cheap Machine 98. If you're looking for the ultimate removable storage scenario, keep the Zip or even the SyQuest SparQ ($200), and add an Iomega Jaz 2 ($450) and Plextor PlexWriter CD-R drive ($380, www.plextor.com). The 2GB Jaz 2 offers SCSI performance and backward compatibility with the original Jaz. The SCSI PlexWriter's 4x writes and 12x reads are tops for CD-Rs these days.

▶ Floppy

Sure, we could have set Dream Machine 98 to boot on the internal Zip drive, but eventually someone would have sent us a file on a damn floppy, and we'd be ruing the day we made our gutsy decision. "Top-quality" floppies from Sony and Teac start around $35. We opted to grab a cheapie from **Alps** ($18, www.alps.com). Does it really matter? No.

ALTERNATIVES: How about a tin of kippers ($5 from any supermarket)? It costs less than a floppy drive, and has a longer shelf life. If you want an über-floppy, buy the LS-120 ($90, www.ortechnology.com). It's a removable storage drive that reads both traditional floppies and its own spacious 120MB capacity discs.

▶ Modem

The 56Kbps modem is still the only viable, inexpensive option for most home computer owners. We're going with the **3Com U.S.Robotics 56K Voice Faxmodem Pro** ($200, www.usr.com). It's X2- and ITU V.90-compliant, and, most significantly, sports a USB port, which we used to free up another IRQ. This external model also gave us the luxury of a pro-quality, full-duplex speakerphone.

ALTERNATIVES: The cheapest 56Kbps modem quote on Pricewatch (www.pricewatch.com) is $34 for the internal A sonic 56K (www.asound.com). You'll have to download the V.90 upgrade yourself for full compatibility with all ISPs. Will it give you 56Kbps throughput? Sure. But that's where the pampering ends. On the high-end, we suggest you look into 384Kbps ADSL, 400Kbps wireless, or 10Mbps cable modems—all of which are unavailable in the vast majority of the United States. The client hardware for all these solutions costs about $250. Monthly service prices vary, though ADSL and cable typically cost between $40 and $50 every 30 days.

▶ Monitor

In an era of larger screens for smaller prices, we swatted all 17-inch monitors from contention, and went with the best 19-inch monitor we've ever seen, the **Sony GDM-400PS** ($900, www.ita.sel.sony.com). With refresh rates of 85Hz at 1280x1024 and 75Hz at the maximum resolution of 1600x1200, the 18-inch viewable display is flicker-free. More importantly, the 400PS is currently the only 19-inch aperture grille monitor available. The gamers and graphic designers among us are sticklers for this technology's superior brightness and uniform color intensity—continuous tone images simply look better when shot through a grille. The monitor has a varying grille pitch of 0.25mm in the center of the display widening to 0.27mm on the edges, and boasts near-imperceptible geometric distortion, and near-perfect color convergence. Brilliant.

In an era of larger screens for smaller prices, we swatted all 17-inchers from contention and went with the best 19-inch monitor we've ever seen.

ALTERNATIVES: If you must save money, go for any one of the many monitors that use Hitachi's original 19-inch shadow mask CRT. Monitors that use this tube have flooded the market and can be had for as little as $600. For $300 less than the Sony display, you get the same amount of screen real estate, but less

continued on page 69

Our Machine Can Kick Your Machine's Ass

In this age of build-to-order computers, retailers can sell you almost any configuration you request. But can they build a better $5,000 machine than the grease monkeys at Maximum PC?

Gateway 2000 is a global leader in direct-order sales. Polywell is a small vendor of high-powered, custom-built systems. We challenged the two companies to send us computers that would beat Dream Machine 98's features and performance. The rules were simple: They had to use Windows 98 (for the sake of a common benchmarking platform), and their machines had to be available for retail sale at the price and configuration quoted here.

Dream Machine 98

$4,924/Not for Sale/Build your own!

Key Features:

- 400MHz Pentium II overclocked to 450MHz
- 128MB generic 100MHz SDRAM
- Matrox Mystique G200 16MB, Canopus Pure 3D II 12MB
- Montego A3Dxstream soundcard
- 9GB Seagate Cheetah Ultra Wide SCSI hard drive
- HiVal 40x40 CD-ROM drive
- 19-inch Sony GDM-400PS monitor
- Cambridge Soundworks MicroWorks

Warranty responsibilities prohibit retailers from selling overclocked processors, but we're not shackled by such bureaucratic wimpitude. Hence, our Pentium II 400MHz is jacked up to 450MHz. We also boast the best motherboard, videocard array, soundcard, CD-ROM drive, and speakers. Unfortunately, because we're not a large manufacturer that can buy wholesale parts, we were unable to fit decadent amenities into our budget. That meant we got toasted by Gateway's 384MB of RAM, TV tuner, and 21-inch monitor, and Polywell's 256MB of RAM, Ultra 2 LVD SCSI hard drive, and CD-R drive. It's sad but true: If you're looking for a complete system, you can get more for your money by buying from a retailer (who can also offer tech support and a warranty). On the flipside, building your own machine is a helluva lot more fun, and our brazen overclocking helped Dream Machine 98 win four out of the five benchmarks that demand CPU firepower.

REAL WORLD BENCHMARKING	
CPU/MOTHERBOARD	210.9
WIN95 APPS	N/A
HARD DRIVE	12.66
CD-ROM	45.3
3D RENDERING	515
DESKTOP PUBLISHING	62
DIRECT3D	98.02
OPENGL	58.6

Gateway 2000

$4,772/800.846.2000

Key Features:

- 400MHz Pentium II
- 384MB 100MHz SDRAM
- STB Velocity 128ZX 8MB, STB Black Magic Voodoo² 12MB
- STB TV Tuner
- Sound Blaster Audio PCI 64V soundcard
- 14.4GB IBM Deskstar Ultra DMA hard drive
- Toshiba SD-M1102 DVD-ROM drive
- IDE Zip drive
- 21-inch Gateway VX1100 monitor
- Boston Acoustics speakers with subwoofer

This pumped-up version of Gateway's G6-400XL came with 384MB of RAM on its Tabor motherboard. The extra memory came in mighty handy during the *Inspire* test, which Gateway would have won if we hadn't overclocked Dream Machine 98. We also liked the 21-inch monitor and spacious 14.4GB hard drive. Unfortunately, the videocard, Voodoo² card, MPEG-2 decoder, and TV tuner take up nearly all the PCI slots, with only a shared slot remaining should you decide to disable the sound chipset soldered to the motherboard and upgrade to an add-in card. Other minuses include only 8MB of 2D video memory, just two 5.25-inch open drive bays, only one processor slot, and a single fan to cool the entire mass of circuitry. But who can argue with the benchmarks? In all, we liked this machine's raw power, but would have traded some of the memory for a CD-R and higher-quality parts across the board.

REAL WORLD BENCHMARKING	
CPU/MOTHERBOARD	191.6
WIN95 APPS	N/A
HARD DRIVE	11.81
CD-ROM	15.3
3D RENDERING	538
DESKTOP PUBLISHING	66
DIRECT3D	92.55
OPENGL	55.1

Polywell

$4,998/800.999.1278

Key Features:

- 400MHz Pentium II
- 256MB 100MHz ECC SDRAM
- 3D Fusion 8MB AGP with DVD, Diamond Monster 2 Voodoo²
- Turtle Beach PCI Surround soundcard
- 9.1GB Seagate Cheetah Ultra 2 LVD SCSI hard drive
- Hitachi GD-2000 DVD-ROM drive
- HP SureStore 7200 CD-Writer Plus
- SCSI Zip drive
- 19-inch Sampo monitor
- AIWA TSCD40 speakers with subwoofer

This machine is the best value of the three, and we're shocked that Polywell will sell it to you for $5,000. Highlights include TV-out on the DVD-ROM drive, a dual-slot motherboard, ECC memory, a Diamond dual-line modem for up to 112Kbps net access, a removable/lockable hard drive with the fastest SCSI interface around, and an Ultra 2 SCSI controller card that also has an Ethernet port. And who can scoff at both a Zip and CD-Rewritable drive for removable storage duties? The only disappointments were the 19-inch Sampo (who?) monitor, tinny AIWA speakers, and modest amount of 2D memory. Strangely, the Polywell didn't do too well on the benchmarks, taking only Direct3D gaming and HD Tach (look at the awesome throughput that the Ultra 2 SCSI interface provides!). Still, this system is packed with awesome extras. Let us know if it's missing your favorite accoutrement.

REAL WORLD BENCHMARKING	
CPU/MOTHERBOARD	188.2
WIN95 APPS	N/A
HARD DRIVE	15.97
CD-ROM	13.2
3D RENDERING	561
DESKTOP PUBLISHING	67
DIRECT3D	99.95
OPENGL	51.65

NOTE: Our Windows Apps benchmark wasn't yet available when we tested these systems. Full benchmark explanations on page 94.

Cambridge SoundWorks Microworks Two crisp satellites, one 6.5-inch subwoofer, and a 67W amplifier define one of the best speaker rigs at almost any price. Just ask our tortured neighbors.

Natural Keyboard Elite The ergonomaniacs among us squealed for a fancy keyboard. So we chose a USB number from Microsoft. It's not too fru-fru, and has great finger response.

color brilliance and uniformity, and slight focusing problems. Still, it's a fine display for casual computer use. If you're itching for a 21-inch display, you can't get a better deal than the Mitsubishi Diamond Pro 91TXM ($1,100, www.mela-itg.com). This bright, true aperture grille monitor offers a 0.28mm grille pitch and does 75Hz at its 1600x1200 maximum resolution. If you don't give a hoot about price, wait a few weeks for the 21-inch Sony GDM-F500 ($1,900). This monitor's screen is truly, absolutely flat for reduced geometric distortion and screen glare, and must be seen to be believed. And are you ready for the F500's superfine 0.22mm grille pitch from edge-to-edge, and 80Hz at the maximum resolution of 1800x1440? Well, are you? Sadly, the GDM-F500, like the two awesome 18-inch flat-panel LCDs we've seen, is priced way beyond our $1,000 ceiling for the Dream Machine's display component. At least for now. Expect all monitor prices to drop as manufacturers push 19-inchers into the price slot previously occupied by 17-inchers.

This thundering box emits rumbles akin to World War II subsonic warfare experiments. And that's just with the volume at "2."

▶ Speakers

There are multimedia speaker manufacturers, and then there's Cambridge SoundWorks. Engineering expert Henry Kloss's company has become synonymous with awesome speakers at reasonable prices, and the **Cambridge SoundWorks MicroWorks** ($249, www.hifi.com) exemplify the master's vision to the letter. This three-piece subwoofer/satellite combo is the best-sounding system under $500. How such strong mid-bass comes out of those tiny 3-inch satellites is beyond comprehension, but the end result, when combined with a 6.5-inch subwoofer, is a match made in aural heaven. A bi-amped 67W amplifier feeds the MicroWorks all the power it needs.

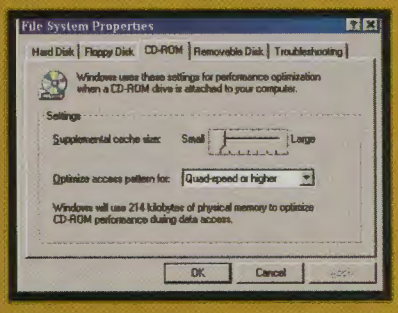
ALTERNATIVES: If you want the most bombastic, freak-nasty bass possible, add the Cambridge SoundWorks PSW1 subwoofer ($700) to the mix. With a 12-inch subwoofer, 140W amplifier, and frequency response down to 20Hz, this thundering box emits rumbles akin to World War II subsonic warfare experiments. And that's just with the volume at 2. *Quake II* and *Unreal* become full-body, force-feedback experiences, and you'll have battlefield flashbacks well into next week.

If you're looking for rich sound for less than $100, buy Altec Lansing's ACS-48 three-piece subwoofer/satellite system ($79, www.altecmm.com). The sub kicks out beefy bass, and the satellites pump warm midranges and sparkly highs.

▶ Keyboard

Half of us didn't want to spend jack on the keyboard. Hell, we'd just as soon buy a used model from Jackie's Swag Shack. The other half of us wanted a fancy-boy ergonomic model to pamper our precious little carpals. But we all agreed the keyboard should be USB. We eventually reached an amicable compromise: Microsoft's **Natural Keyboard Elite** ($65, www.microsoft.com), an ergonomic beauty with support for both USB and PS/2 (adapters included). The sleek Elite has a small desktop footprint, and newly designed half-sized function and cursor control keys. All the keys have resounding tactile response and are intelligently spaced and positioned.

ALTERNATIVES: To save money, visit your local flea market and buy any $5 keyboard that doesn't appear to have weird stains on it. If ergonomic keyboards just plain disgust you, consider Cherry's G81-8004 ($85, www.cherrycorp.com), a full-sized 104-key keyboard with 43 programmable keys and an integrated side-mounted smart card reader/writer.



6 Optimize CD-ROM settings

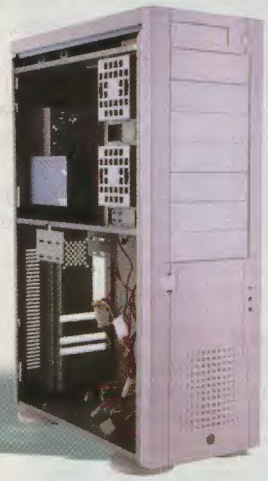
Don't forget to enable your CD-ROM drive's Direct Memory Access (DMA). DMA takes a load off the CPU, transferring data directly to memory instead of relying on the CPU to negotiate the data flow. Go to the appropriate drive under Device Manager, click Settings, and enable the DMA option (if it's present). Now set the drive's cache. Under System Properties click the Performance tab, then click the File System button and select the CD-ROM tab. For best results, set the CD-ROM cache to Small for multimedia and gameplay, or to Large for database access. Optimize the access pattern for quad-speed or higher.

MouseMan+ This Logitech mouse has four programmable buttons and a rolling finger wheel. But that's just icing. We chose it because it feels so damn good.

▶ Mouse

Half our staff uses the 400dpi **Logitech MouseMan+** ($41, www.logitech.com), the best mouse we've ever seen. Molded to fit your hand, it's designed for comfort and ease of use, with four programmable buttons, including a thumb button and a rolling finger wheel. Logitech's outstanding MouseWare driver software lets you program all four buttons for any of 50 functions accessed through the control panel, including all the F-keys, nav keys, modifiers, and a bunch of time- and motion-saving capabilities. The wheel even lets you scroll up and down and zoom through interfaces within most Win98 documents.

ALTERNATIVES: For a cheap and basic alternative, you can go to your local CompUSA and get a no-name, two-button rodent for $1 with rebate. And since you can't get anything better than the MouseMan+, you might want to choose a game controller to go along with your mouse. The Microsoft SideWinder Force Feedback Pro joystick ($122, www.microsoft.com) is the best-implemented force-feedback joystick available.



Addtronics 7890A We were sold on the beefy 300W power supply, seven 5.25-inch drive bays, and eight fan bays. A perfect case for expansion and chop-shop tomfoolery.

▶ Case

Is bigger better? No. But more drive bays is better, and the **Addtronics 7890A** ($198, www.wco.com/~addtron) had us in expansion heaven. It features seven 5.25-inch drive bays that slide out on rails, along with eight fan bays—we filled five of them for more-than-adequate chilly-chill. To power all the fans and peripherals, we opted for a 300W power supply. The swing-out doors, height-adjustable feet, and detachable motherboard tray helped seal the deal.

ALTERNATIVES: For a slightly cheaper option, we recommend the CompuDEX IW-Q500 ($130, www.compudex.com), a full-size tower beauty. And, of course, there's no proof that you *can't* mount your parts in an old frig. Boy, boy, crazy boy. Keep cooly cool, boy...

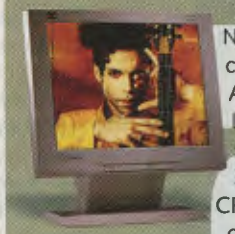
Windows 98 What can you say about Windows 98? It's not the most stable, most powerful, or most inexpensive OS. It simply is. And it runs all our favorite games and applications.

▶ Operating System

Windows 98 is the OS-du-jour and will cost you $170 to buy it outright (an upgrade from Windows 95 costs $90). Until Windows NT offers full application and DirectX support, we'll be sticking with Microsoft's consumer OS. It's got a browser built right in, and, hell, some newbies say it's is even easy to use.

ALTERNATIVES: The irrepressibly customizable Linux (www.linux.org) is the darling of most web admin types and is absolutely free. Unfortunately, its hardware and application support is still too sketchy for us to fully endorse it for Dream Machine 98. ✹

Dream Machin



Dream Display 1999: Equipped to party as predicted (and skinny, too).

Next year's machin could be based on AMD's K7 process Launching at 500MHz+, this 3DNow!-optimize CPU is slated to run on a 200MHz syst bus. AMD will hav to improve its inte and floating-point performance to sw us away from Intel's 500MHz+ Pentiu II Katmai. This CPU will follow the P-I lineage we're all familiar with—L2 cac amount and speed won't change—bu will include 70 new instructions design to boost 3D-gaming performance.

In 1999, AGP 4x videocards will be ready for prime time, promising even faster texture memory storage and exe cution. Games will be optimized via hi res textures and deeper color depths f 1024x768, so prepare yourself for kille immersion. S3's Savage3D, Number Nine's Ticket To Ride IV, nVidia's TNT4 and 3Dfx's next-gen accelerator (code named Rampage) all look like strong contenders to fulfill Dream Machine 9 video duties.

The sound battle looks to be ugly. System and speaker manufacturers wi push for true digital audio piped throu USB ports—thus killing the necessity f soundcards. Soundcard manufacturers meanwhile, will fight to maintain rele vance by trumpeting support for 3D audio APIs. Regardless, in 1999 we'll need hardware support for Dolby Digi

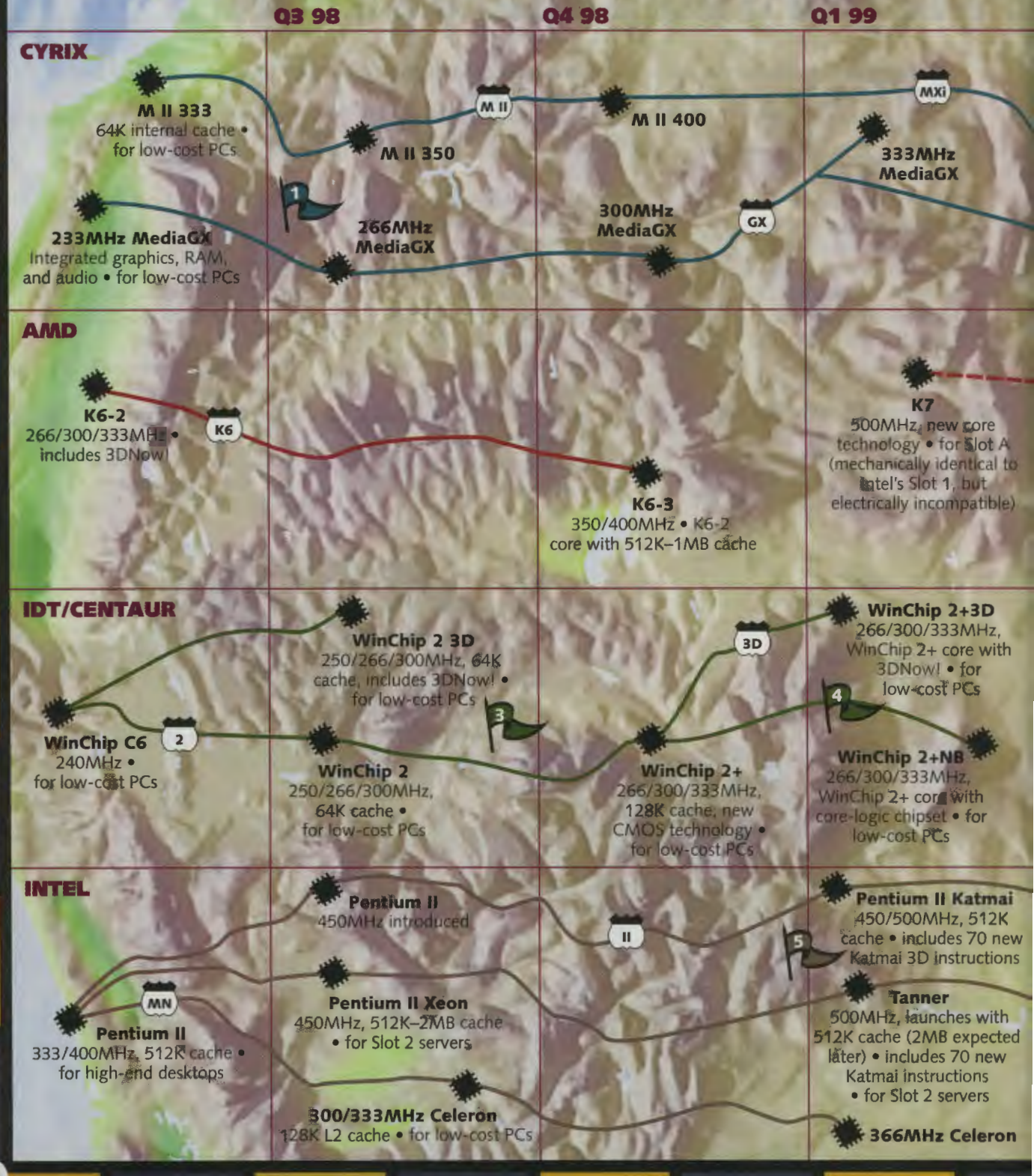
Next year's hard drive will use Ultra LVD (Low-Voltage Differential), delive ing wider bus bandwidth and burst potential of up to 80MB/sec. While 10,000RPM Ultra DMA ATAPI drives be emerging, we predict we'll be stick with SCSI due to IDE's architecture restrictions. Regardless of interface, pr ing will force us to decide between a gle large drive (around 18GB) and two drives in a RAID array. CD-ROM? Fawgetaboutit. DVD-ROM drives will reading CD-ROMs at 32x, and DVD-ROM software will be ubiquitous.

Finally, in 1999 Windows NT 5.0 w replace Windows 98. Games and gam hardware should take advantage of N multithreaded environment and dual-processor capabilities.

And our case? We're hoping for hunter green.

a MAXIMUM PC production

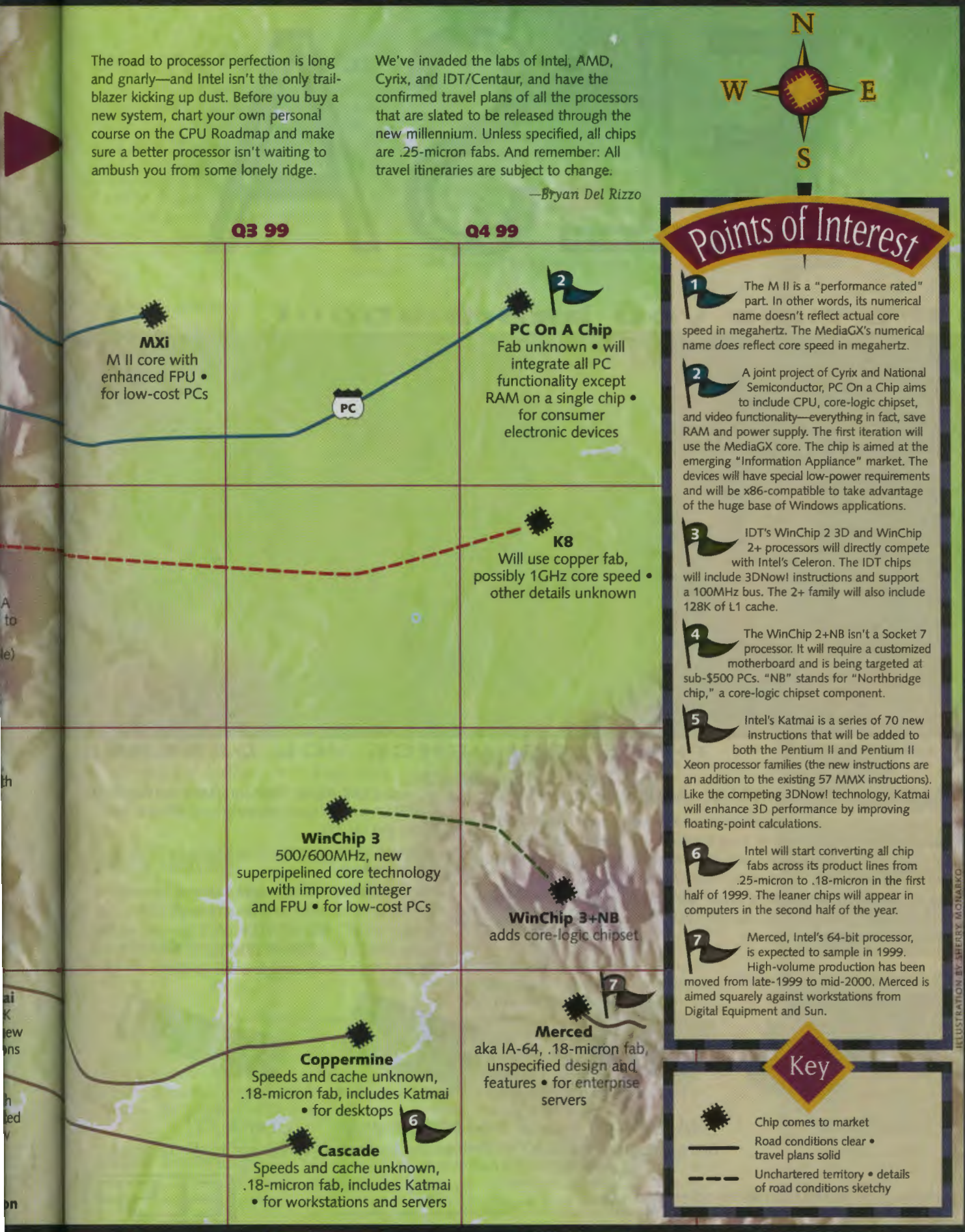
CPU Roadmap 2000



The road to processor perfection is long and gnarly—and Intel isn't the only trailblazer kicking up dust. Before you buy a new system, chart your own personal course on the CPU Roadmap and make sure a better processor isn't waiting to ambush you from some lonely ridge.

We've invaded the labs of Intel, AMD, Cyrix, and IDT/Centaur, and have the confirmed travel plans of all the processors that are slated to be released through the new millennium. Unless specified, all chips are .25-micron fabs. And remember: All travel itineraries are subject to change.

—Bryan Del Rizzo



Points of Interest

1. The M II is a "performance rated" part. In other words, its numerical name doesn't reflect actual core speed in megahertz. The MediaGX's numerical name *does* reflect core speed in megahertz.

2. A joint project of Cyrix and National Semiconductor, PC On a Chip aims to include CPU, core-logic chipset, and video functionality—everything in fact, save RAM and power supply. The first iteration will use the MediaGX core. The chip is aimed at the emerging "Information Appliance" market. The devices will have special low-power requirements and will be x86-compatible to take advantage of the huge base of Windows applications.

3. IDT's WinChip 2 3D and WinChip 2+ processors will directly compete with Intel's Celeron. The IDT chips will include 3DNow! instructions and support a 100MHz bus. The 2+ family will also include 128K of L1 cache.

4. The WinChip 2+NB isn't a Socket 7 processor. It will require a customized motherboard and is being targeted at sub-$500 PCs. "NB" stands for "Northbridge chip," a core-logic chipset component.

5. Intel's Katmai is a series of 70 new instructions that will be added to both the Pentium II and Pentium II Xeon processor families (the new instructions are an addition to the existing 57 MMX instructions). Like the competing 3DNow! technology, Katmai will enhance 3D performance by improving floating-point calculations.

6. Intel will start converting all chip fabs across its product lines from .25-micron to .18-micron in the first half of 1999. The leaner chips will appear in computers in the second half of the year.

7. Merced, Intel's 64-bit processor, is expected to sample in 1999. High-volume production has been moved from late-1999 to mid-2000. Merced is aimed squarely against workstations from Digital Equipment and Sun.

ILLUSTRATION BY SHERRY MONAIKO

Key

- Chip comes to market
- Road conditions clear • travel plans solid
- Unchartered territory • details of road conditions sketchy

More PCI, Fewer IRQs?

I would like to build my first PC and am looking for a motherboard with five or more PCI slots and dual–Pentium II support. I saw the Tyan S1836DLUAN, which meets these requirements, but in addition it has a soundcard, SCSI, and Ethernet built in. I'd like to know if the six PCI slots are going to be useful, or are all the IRQs going to be used up by onboard features? Does Tyan have another set of IRQs for these features? Or, maybe IRQs can be shared by the PCI architecture?

—Ed Sanchez

The Doctor Responds Six PCI slots will be very useful and we hope will be the minimum on all motherboards. Numerous IRQs will be required, although they can be shared when using cards that comply with the PCI 2.1 specification. That particular motherboard also gives you control over every aspect of the BIOS, making it easy to control IRQ assignments manually.

No Power, Power Supply

Will an ATX power-supply fan come on if the power supply is plugged in and turned on? I have a new ATX case, and when I turn the power on the fan doesn't even come on. I have checked all the connections several times. I think the power supply is bad.

—Scott Dahlstrom

The Doctor Plugging in a power supply, turning it on, and getting nothing doesn't necessarily mean its bad. Many require at least one device to be connected to complete an electrical circuit and supply "pull." If you've done this and it still doesn't work, then it is indeed bad. If the power supply works, yet the fan doesn't come on, it's a good sign that the power supply will soon fail, most likely due to overheating.

Phat Utility

Have you ever heard of a utility that will convert my hard drive to FAT32 without formatting my drive and losing all my data? I know the hard way, but I'm too impatient to wait half a day to back up my whole hard drive and reformat it again.

—Javier Villa

The Doctor Actually, Windows 98 comes with a utility for doing just that. You can also use *System Commander Deluxe* from V Communications, a handy utility that converts FAT16 to FAT32 and vice versa; it's great for when you need to install OSes that don't support FAT32, such as NT 4.0.

BIOS Overlay

Is there such a thing as a BIOS overlay program? I have a 486DX computer with two Seagate hard drives, one an ST-11024A and the other an ST-3144A. The original BIOS does not recognize the hard drives.

—David Scannell

The Doctor Check out *DrivePro* from MicroHouse software (www.microhouse.com). It comes with a utility called EZ-BIOS that replaces the conventional Master Boot Record, taking up residence on the hard drive instead of volatile CMOS. It comes with support for almost all hard drives. You can also get this kind of support from Ontrack *Disk Manager* (www.ontrack.com).

Stuck in DOS Compatibility Mode

I have an 850MB Conner hard drive in my home-built PC. When I click on Control Panel, then System, it reports that the drive is using MS-DOS compatibility mode. I know it's been in normal 32-bit mode before, and I'm not sure how to get it back to that mode. I need the 32-bit mode to run Windrenalin!

—Justin Thompson

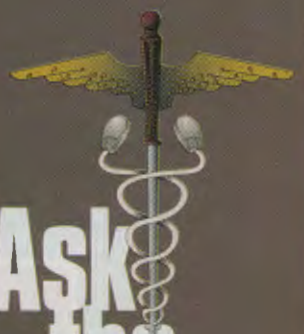
The Doctor It sounds like you don't have the correct Primary, Secondary, or both busmaster IDE drivers loaded, they're loaded improperly, or the drivers can't load due to lack of resources (an IRQ or memory address that is either unavailable or in use). Open the System icon in the Control Panel and check the Device Manager for any yellow or red exclamation marks that would indicate a problem. If you have a ATX motherboard, then you most likely need to download the busmaster IDE drivers from Intel's site (developer.intel.com/design/pcisets/drivers/inf_update.htm).

Black Bars On Channels 2 And 14

I have a problem playing games on my new 19-inch monitor. I love the monitor but none of my games use the full screen. I have a 2-inch black strip down the left side of the monitor for most of my games. Is there any way to correct this? My 2D/3D videocard is the Diamond Stealth II S220, and my 3D card is a Monster 3D. Please let me know if there is a workaround for this situation.

—Joe Pounder

The Doctor Assuming you're only playing 3D games at full-screen, this is solely a Monster 3D issue. First, you can try playing at different resolutions until you find one that defaults to fill more of your screen. The rub here is that low resolutions look pixelated, and high resolutions can slow framerates to a crawl. Second, in lieu of resolution tampering, you can use your monitor controls to expand the image defined by the Monster 3D's video signal. You'll fill a bit more screen real estate, though two inches will be a stretch. (You can also reposition the image so you have an equal amount of dead space on each side of the screen.) Third, try mucking with the



Ask the doctor

SYMPTOM DIAGNOSIS CURE

Even the burliest of PCs comes down with a bug every now and then. That's when you need to call the doctor and get a diagnosis that'll have you up and running in no time.

Send your symptoms to: doctor@maximumpcmag.com.

Monster 3D's refresh rate. A lower rate could pop the screen back in place. Fourth, update your Monster 3D drivers—updated software never hurts. Finally, you can just accept reality and live with the 2-inch black strip that everyone else has encountered.

Adding On And On

I'm thinking of building a system with an AGP videocard, a Voodoo² 3D accelerator, and an MPEG-2 decoder card. I know that both the Voodoo² card and the MPEG-2 decoder board require video pass-through. So, how would you set that up?

—Czechguy7

I'm currently shopping around for a 3D videocard, but there is one detail I need to straighten out first. My 2D card is a 4MB Matrox Millennium, and I recently bought a Creative Encore Dxr2 DVD kit. The videocard connects to the Dxr2 decoder card via a loopback cable. If I get a 3D card that also uses a loopback cable, in what order should the three cards be connected? Should it be 2D card, 3D card, then the Dxr2 board, or should it be 2D, Dxr2, then 3D?

—David Greer

The Doctor takes out two birds with one stone Most folks will want to get their daily dose of TV-output, so you should put the Dxr2 at the end of the video signal chain. You can now play your 3D card through it and get hot polygon action on your boob tube. The chain should look like this: 2D card -> 3D card -> Dxr2 (MPEG-2) board.

Scotty, Get Me Those Framerates!

I recently bought a Diamond Monster 3D II and I can never seem to get the framerates cited in various magazines.

I'm running a 266MHz Pentium II with 128MB of SDRAM on an Abit LX6 motherboard. For 2D I'm using a Viper V330 AGP. When I run *GLQuake II* with timedemo2, I only get 37fps at 640x480. I'm not overclocking my system and in the BIOS I'm using the default settings for a 266.

I know I will not get 88fps, but I should be getting more than 37fps. I'm at a complete loss. I have tried to use overclocking for the Monster that is provided with the drivers, but that did not help.

—Dominique Démoré

The Doctor Remember, many other publications test Voodoo² boards with practically everything else disabled—this includes sound, network, and so forth, which will affect benchmark scores.

We just tested a Voodoo² reference board on a 266MHz Pentium II (64MB EDO DRAM, etc) at 640x480 *Quake II* and got 45fps. To get higher framerates, go to your Advanced Properties sheet in your Voodoo² Control Panel, and check the Don't sync to vertical refresh rate button on both Glide and D3D. This permits the Voodoo² board to continue to update your display without having to wait to sync with the vertical refresh rate. In theory, this will give you faster framerates, but may induce visual artifacts in the form of shearing and tearing of graphics. If it'll make you feel better, run your *Quake II* tests and disable all your other options.

Onboard Video Welded On

I have an older 100MHz Pentium, a Hewlett-Packard 7050, and want to install a new videocard. The current S3 Trio is soldered onto the board, so I have to screw around with jumpers to correctly detect the new card. I looked for a diagram of the board, searched HP's entire site, and even called them, but I think my service warranty has expired, which means $25 per hour for help.

I have looked for books with my weirdo motherboard, but none exist. I finally tried experimentation, mixing and matching the jumpers, and booting the sucker, but that didn't work either. I would try a Voodoo board, but they are expensive (at least more than I'm willing to pay) and only accelerate full-screen graphics.

I'd also like know if it's possible to put a new Ultra DMA drive in my machine. It has EIDE and I don't care about the DMA mode.

—Frank Moskos

The Doctor I hate to be the one who breaks it to ya, Frank, but you cannot disable that onboard S3 chip. This was told to me by an HP service rep and was also tested in our labs. So no jumpers in the world will allow you to banish that dreadful thing. A word of advice, though—don't go monkeying around with jumpers without an instruction sheet handy—bad things can happen to your system.

You can add a Voodoo board into the mix, but it will only do full-screen graphics. But why would you want to play your games in a window, anyway? This may be weird in an integrated situation such as Microsoft's forthcoming Chrome 3D desktop application, where D3D hardware acceleration is called into action for your desktop display. Other than that, you're

Overclocker's Corner

Direct3D Tweaks?

Everything I've read on the net and every overclock tweak program I have tried only help with Glide/OpenGL programs. Can you help with overclocking Direct3D on a Voodoo card?

—Anon

The Doctor Go into your AUTOEXEC.BAT file and look for the line:

SET SST_GRXCLK=

This variable sets your Voodoo board's clock speed (in MHz). This speed adjustment will affect both D3D and Glide applications. Most will default to 50, so all you would need to do is change the number to a higher value and reboot your system. Folks have taken their Voodoo boards up to around 57MHz without any major problems, but bear in mind that you will be pushing the chips harder, thus they'll generate more heat, which will shorten their lifespan. Unless you plan on giving these chips generous cooling (via fans, heatsinks, or both), your pixelfx/texelfx chips may melt into puddles of silicon sludge if you're not careful. You have been warned.

Overclocking Rendition

I own a Diamond Stealth II card and I've been desperately waiting for an article on how to overclock a Rendition V2100 videocard. Please, point me in the right direction. I've done web searches, but I can't seem to locate a "how to" page for overclocking this card. My suffering goes on. Thanks in advance for any information you can offer.

—Brian Smith

The Doctor For the Vérité V2100, the easiest way to overclock your board is to download any of the Vérité tweak programs available. Try visiting some Rendition fan sites—two that spring to mind are Bjorn's 3D World (www.bjorn3d.com) and Nine's Rendition *Quake* and *Quake II* Workshop (www.nine3d.com). If you feel the need to hack it yourself, you should create or edit your configuration file in your

80 ▶

only other add-in card choice would be one based on PowerVR's PCX-1 architecture, but we wouldn't recommend it for your CPU speed.

Ultra DMA drives are backward compatible with EIDE. Although there is a very slight risk of data corruption, we haven't experienced that, nor has it been reported to us.

Confused About 3D

I own an HP Pavilion 8260 266MHz Pentium II and would like to get a graphics accelerator. But every time I read an article, review, or preview I'm sent back to square one with more information but less of a direction in which to go. Since I have an AGP slot, wouldn't it behoove me to use it instead of a PCI card? Is it necessary to have more than 100fps to enjoy a first-person shooter? Shouldn't the i740 chip be given more credit for delivering the numbers it did in screen resolutions over 800x600?

—Mark Fecheimer

The Doctor With regards to your AGP slot, use it! There's a mess of new 3D accelerators coming out that will give you the same 3D performance as a single Voodoo^2 card. Read up on page 86 for S3's latest, the Savage3D. Matrox is also coming out rip-curled and ready to pump you up on page 109. But, nothing coming out this Q4 will match the raw fury of dual SLI Voodoo^2. But, not everyone has $600 to blow. Although 100fps is overkill for today's games, any card that can push that now should have the horsepower to pump next-generation games that will push twice the amount of polygons and bump up those textures at 40fps to 60fps. The i740 is a great entry-level 3D accelerator card, but its time in the sun is waning fast, as Matrox's newest board is slapping it all over the place. Six months is a long time in the 3D accelerator world.

Can't Get No Quake-isfaction

I recently purchased a Diamond Stealth II G460 AGP videocard that uses the i740 chipset and 8MB of SGRAM. I am having some problems running *Quake II* in OpenGL. The Intel i740 chipset is supposed to support OpenGL, and even your magazine commented on how good *Quake II* looked with it. Do you think Diamond altered the support capabilities of the chipset or does this sound like a common problem for all new videocards?

—Open GL Blues

The Doctor It sounds like you've got the older Stealth II G460 drivers. Diamond recently released its latest display drivers, complete with OpenGL ICD for your *Quake*-ing pleasure. Go to www.diamondmm.com and download the latest drivers. Once you do, when you fire up *Quake II*, simply choose the Default OpenGL driver and it should load the i740 driver.

AMD Supports 100MHz RAM?

I was looking at getting a 300MHz AMD K6. Do I need to purchase the PC100 SDRAM, or can I stick with my normal SDRAM? I guess the real question is whether the K6-300 has support for 100MHz RAM.

—Neil E. Christensen

The Doctor Which K6 do you plan on shackin' up with? If you go with the regular 300MHz K6, then 66MHz SDRAM will work fine. But if you plan on going with the newer 300MHz K6-2 with 3DNow! technology, go with 100MHz SDRAM. Also, check the motherboard specs to see what memory your core-logic chipset will support.

Annoying Direct3D Pause

How can I get rid of those annoying pauses in every D3D game I play in Win95? Every few minutes or so, I encounter three short pauses (no matter what the game is). I think it's because of the swap file. But wait a minute, I have 32MB RAM and my swap file is 100MB in size (both min and max setting)! It shouldn't be my hard drive either, since I benchmarked it around 4.5MB/sec. So I'm totally frustrated with this problem and don't know if I should get more RAM or a new drive.

—Richard Chiu

The Doctor Which games are giving you the hiccups? To check if it's the swap file, try firing up one of your D3D games, then observe the hard drive LED as you play—if it lights up and your gameplay bogs down simultaneously, then it's your virtual memory playing tricks on you. Believe it or not, 32MB is bare minimum for today's memory-hungry apps, and with a bloated OS sitting there (mis)managing memory, you're bound for some trouble.

A couple of quick things to try before dipping into the ducats and splurging for more memory—do a thorough defrag of your hard drive and make sure you also defrag the swap file as well.

If you have a separate hard drive partition that's not being used at the moment

Overclocker's Corner

\windows folder. It's called VERITE.INI, and if you don't have one already, you can create one in notepad.

If you have a VERITE.INI file already, make a backup of it, then open it with Notepad—you should see:

[display]
m=xx
n=x
SClkP=x
MClkP=

where 'x' is a numerical value that acts as multipliers for the memory and core engine speeds. The formula for memory speed is: 14.318*m/(n*MClkP) MHz, while the core engine speed formula is: 14.318*m/(n*SClkP) MHz. By default, it sets to m=14, n=1, SClkP=5, MClkP=2. From here, you can start fiddling with these numbers to squeeze out that extra frame or five.

1) First, set new values for n, SClkP, and MClkP to:

n=2
SClkP=4
MClkP=2

2) The m value will be the major factor in your overall Stealth II speed. From its default, try changing the value to:

m=45

Now, save the file and reboot the system, then benchmark away with *Quake II*. See any difference? If you want to squeeze a little more, you can bump up the m value by 1 or 2 and continue this until you encounter problems, such as lock-ups. Remember, write down the original settings and make sure you create a backup copy of your old VERITE.INI file before attempting any madness. You may also want to look into some type of cooling.

Riva Overclocking

Could someone show the viewers at home how to overclock nVidia's Riva 128!

—Ed Lingenfelter

82 ▶

or has very little data, try pointing your swap file to that drive. If your games still stutters, you'll need to bump up the RAM to at least 64MB—a preferred place to be in a Win95/98 situation, to be honest.

RAM Killed The Radio Star

Only the Gods of Arcane Technology can answer this one. I have a generic Socket 7 TX chipset motherboard running a 233MHz AMD K6 with 64MB of SDRAM. I have overclocked it to 75MHz on the bus and decreased the multiplier to 3x for a chip speed of 225MHz. This configuration puts out more power than the 66MHz bus and 3.5x, 233MHz configuration. With these settings, this little puppy puts out a score of 98 in Norton's System Information—not too shabby.

My problem is that when I yank the two 32MB DIMMS and put in one 64MB SDRAM chip that is 100MHz compliant, I got the same score of 98 (as expected). But if I mix the 64 and 32MB chips to get 98 megs of blistering SDRAM the bootMark drops to 70! I've set the clock speed back to 66MHz X 3.5 and the bootMark is still 83 with nonmixed RAM and 70 with mixed ram. What happened?

—Joe Page

The Doctor Mixing memory types in systems is always a recipe for trouble. Speed difference between SDRAMs may cause timing problems, which will result in those lower scores. First of all, check your BIOS settings to see how your RAM timings are set—you should set them to conform to the type of SDRAM you have. The best place to get the proper settings is to go either to your motherboard's web site and check for any FAQs on your particular board, or to the memory manufacturer's site to check if they have proper timing settings for your RAM.

Generally, for optimal performance, you should only use identical memory types if you plan on going with more than one DIMM. You may need to bite the bullet and decide whether you want to get another 64MB DIMM from the same place you bought your first one, or just sit on the chicken-combo you already have.

Sun Sets On Monster

I think my Monster I has met its end because every time I start *Quake II* or *Unreal* my system locks. I have deleted and reinstalled the Monster drivers and Voodoo Direct3D drivers, Glide 2.43, OpenGL, and the games too. I have changed memory-range settings and even formatted my PC and started over from scratch. What else could be wrong here? I mean, the refresh rate test utility works fine, why not the games?

If this is the end of the road for this beast, who is the fastest Voodoo² right now?

—Dory Hayes

The Doctor It looks like you've done just about everything you can, but did you also re-install DirectX? Also, check your soundcard to see if any weird IRQ conflicts exist. Have you tried Direct3D games? Fire one up and see if it works. Ensure your Monster 3D is properly seated in the PCI slot—try powering down the system, pulling out the videocard, then reseating it into the PCI slot. Fire your system up and check again. You may also want to move the Monster 3D to another PCI slot.

A great way to test whether it's the hardware is to try slapping your Monster 3D into another machine, if you have one handy.

If all this doesn't work, and the Monster 3D has shuffled off its mortal coil, try seeing if you can get Diamond Multimedia to replace it, if it's still under warranty.

In any event, if you decide on falling into Voodoo²'s arms, then Canopus's Pure 3D II is a great place to start. With TV-output and a smaller formfactor than the average Voodoo² board, it's a winner in our book (being overclockable to 100MHz doesn't hurt either). Not interested in TV-output? Try either Canopus's Pure3D II LX or Metabyte's Wicked3D Voodoo² board.

Quakeless in Seattle

I'm having problems running *GLQuake* on my ancient 166MHz Cyrix PC that I recently retrofitted to a 200MHz AMD with a PowerVR card. After running *Quake II* for a few seconds, it shuts down, leaving me with an oversized desktop and a very unhappy expression on my face. The software-rendered *Quake* runs fine, and even the "OpenGL" version using the Cyrix chip doesn't have any problems (except unplayable slowdowns). I'm guessing that the John Doe motherboard doesn't support the AMD 200MHz CPU even though voltage settings are OK and the BIOS detects the CPU perfectly. I'm looking forward to buying a brand new Pentium II computer with the best available 3D card in a couple of years. For now, I would like to know what my immediate solution should be: new board, or go for a new Intel 200MHz MMX Pentium CPU and let the AMD and Cyrix sit on the shelf?

—Patrick Boutin

The Doctor Before you chuck your old AMD CPU to the curb, triple check some things. First off, see if you can find some

Overclocker's Corner

The Doctor There are ways of monkeying around with the memory speed of the Riva 128, but quite honestly, there may not be that big of a performance boost from doing so.

Overclocking Multiplication

I finally cranked up the internal clock speed of the motherboard (a Mustang-534F) from 66MHz to 75MHz. My 200MHz MMX Pentium system seems to be fine, reporting a 225MHz CPU. There is also a footnote on the manual indicating an 83MHz setting, but I wanted to remain conservative for my first overclocking attempt. What I really wanted to know about are the infamous multiplier settings that keep getting mentioned whenever someone talks about overclocking a CPU. They don't seem to be explained anywhere. It seems to be taken for granted that the reader knows what they are. I hate feeling like an ignoramus for asking, but if I don't ask, I'll never know. What exactly are they, and how are they set?

—Pablo R. Arévalo

The Doctor The multiplier setting is a set of jumpers that determines what number to multiply the system-bus by. These numbers will range from 2.0 to 5.5, moving in .5 increments. For example, 200MHz would be obtained by setting your system bus speed to 66MHz, then setting your multiplier to 3, resulting in 66MHz x 3, or 198MHz. What you did in your situation is bump up the system-bus speed to 75MHz—75MHz x 3=225MHz. Take a close look at your motherboard and look for a tightly grouped set of jumpers. Nearby should be a chart that tells you how to set for different multipliers. By fiddling around with these settings alongside your system-bus speed, all types of crazy speeds are possible. But beware, by fiddling with the system-bus speed, you'll also be overclocking your PCI slots, which usually sit at half the system-bus speed, so at 66MHz, the PCI bus speed will be 33MHz. Bumping it up to 75MHz overclocks the PCI slots to 37.5MHz. Some components, especially videocards, may freak out when bumped up in this manner.

hard specs on that motherboard to see if the board truly supports AMD's K6 CPU. Make sure you're not overclocking your motherboard and/or PCI slots. If you're running faster than a 66MHz system bus, this may cause problems.

Second, you may want to re-install your *Quake* games. Adding hardware and other experiences tend to make *Quake* act the fool. Make sure you have the proper OPENGL32.DLL placed in the proper directories and download the latest version of the driver from PowerVR's web site (www.powervr.com) or go to Matrox's site (www.matrox.com).

It Locks Me Up

I have an Asus 440BX motherboard, and ever since I got this board, *Quake II* seems to lock up on me and kick me out, giving some fault error messages. Is it the board, the videocard (it's a Millennium II with a Voodoo² Monster3D), or something else? *Unreal* and *Forsaken* also lock up on me.

—X-Man

The Doctor That combination of hardware has been used successfully here. There could be several things affecting your system. If you're overclocking your machine or videocard you might try taking it back down. Have you loaded the latest video drivers and reinstalled DirectX 5? Reseated the PCI cards? If you have the backup components, you can swap out devices one by one until you isolate the bad part. Unfortunately, from the information you've supplied, it sounds like it could be almost anywhere in your system.

Give Me The Full Install

I plan on building a new computer with the hottest components but have little experience in operating systems. I was wondering how to install the most current OS, Windows 98, for my new boot system. Almost everywhere I look I find upgrades. I know Win95 upgrades Win3.1 and DOS, and the Win98 upgrade changes Win95, Win3.1, and DOS to Win98. However, I would like to get one package to be able to go straight to Win98. Is there such a thing? And once I pull everything out of the box, piece all the components together, and power it up how do I install this OS?

—Gary Hammond

The Doctor Microsoft currently offers both a full install and an upgrade version of Windows 98. The full install should be on store shelves by the time you read this. The full install version includes a boot disk with generic IDE CD-ROM drivers on it and scripts to get you on your way. You should also note that you can perform a full install from the upgrade version of Windows 98. The installation process will ask for your Windows 95 disc as proof that you have it when installing to a newly formatted hard drive. If you can't find the full version on the shelves, some vendors are offering OEM versions of Windows 98 on the Internet with the purchase of certain components. One way to install from fresh is to boot off disk with DOS CD-ROM drivers, FDISK the drive, reboot, FORMAT the drive, click over to the Win98 directory on the CD, and start SETUP.EXE.

Ping Too Fast

Could you please tell me how too slow the programs PING.EXE and NETSTAT.EXE so that I can read the screen before it shuts down?

—Ceizer

The Doctor Simply invoke the commands from a DOS box in Windows 95 and append it with |more. Example: "C:\PING.EXE |MORE".

No Sound On Soundcard

I upgraded to Windows 95 and my soundcard doesn't work anymore. I can play music CDs in the drive, but nothing else makes noise.

—TeamShowMe

The Doctor It's tough to gauge your situation without a little more info. Try double-clicking on the speaker icon in the system tray on the right-hand side of the screen. You'll see different slider controls. Make sure the sliders for volume and wave are cranked up. You can also try updating to the latest drivers for your card by downloading them from the web. You may also want to try removing the soundcard from the Device Manager accessed through the System icon in the Control Panel. Windows 95 should autodetect the card and reinstall drivers for it. Also look for IRQ conflicts within the Device Manager.

Turn Off Voodoo

Can a 3Dfx card be turned off (on-the-fly) so I can use resolutions higher than 800x600 without investing in another 3Dfx card? I use *Photoshop* a lot and need to access my videocard for higher resolutions.

—Jaff 9

The Doctor Assuming you're using a Voodoo-based board and not a Voodoo Rush, you shouldn't have to worry about it. Resolutions set for your Voodoo card only affect applications or games that are using it. Setting your primary adapter to, say, 1024x768, will have no impact on your Voodoo card.

RAM Hungry Windows

I have a 200MHz MMX Pentium, which I recently bumped to 64MB of RAM. While playing around with System Monitor, I saw that Windows was using a constant 17.7MB of my RAM for hard drive cache! Is this the price I pay for zero swap-file activity? Is there any way I can limit the cache size? Please help!

—Dan Grove

The Doctor Windows 95 eats RAM like people eat popcorn. If you edit your SYSTEM.INI file in your Windows directory, you can add these two lines to limit the amount of RAM set aside for caching under the [vcache] section and then reboot.

MinFileCache=0
MaxFileCache=8192

It specifies minimum and maximum file size for a disk cache. What's the right size? That depends on what your needs are.

Where Did Suspend Go?

A while back, I had to reinstall Windows 95 for the "umpteenth" time. I had to have my computer manufacturer on the phone. A long distance call. They gave me an option to remove my Suspend feature in my Start menu. They actually took me to one of many screens in DOS with features I could change for Win95 while they were walking me through numerous options. Anyway, Win95's running A-OK so far, and tech support didn't say Suspend must forever be gone. Now I'd like it back, but I forget how to do this. And without wasting money on a long-distance phone call, how can I get my Suspend mode feature back into my Start Menu?

—Ryan Weber

The Doctor Assuming you're running the OSR2 version of Windows 95, go to: Start, Settings, Control Panel, Power, Advanced, and then click on the "Show Suspend on Start Menu" box. ✹

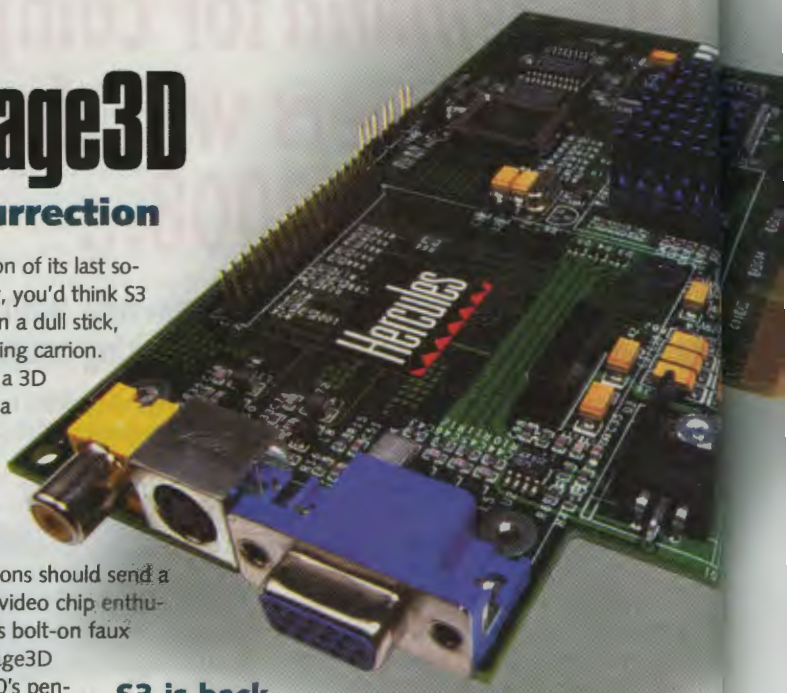
PREVIEWS

HARDWARE ON THE HORIZON AND SOFTWARE SOON TO SHIP

▶S3 Savage 3D . . 86
▶C-Cube 89
▶HiVal DVD-RAM 90
▶Illustrator 8 . . . 92

S3's Savage3D

Alienation resurrection



hands on MAXIMUM PC exclusive

After the crucifixion of its last so-called 3D offering, you'd think S3 was dead meat on a dull stick, nothing but stinking carrion. But S3 is staging a 3D resurrection with its Savage3D, a new 2D/3D videocard architecture hell-bent on silencing the naysayers (present company included) who've said it could never be done.

Savage3D's initial specifications should send a tingle up even the most jaded video chip enthusiast's spine. Unlike the ViRGE's bolt-on faux "3D," the .25-micron fab Savage3D follows the Matrox MGA-G200's penchant for dual processing, implementing a 128-bit rendering pipeline via dual 64-bit processors working in parallel. Like the MGA-G200, the Savage3D will render scenes internally at a higher color depth than what may be finally used, in this case, 24 bits.

S3 is back with a savage vengeance and benchmarks that beat 3Dfx.

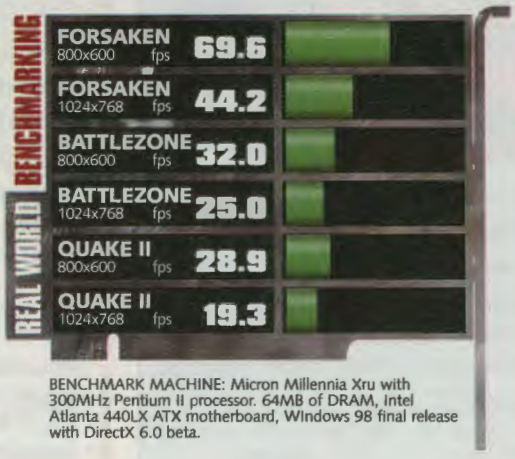
Rendering will be performed via the standard vertex-based rasterization process, as opposed to the "chunking"-style rendering architecture used by PowerVR or WARP 5. The Savage3D does use a tile-based memory system and will be API-friendly, so DirectX/Direct3D games as well as OpenGL applications (via ICD) will take advantage of this chip's new power.

Packing much of the same power of more silicon-intensive cards, the Savage3D utilizes a single-cycle 3D pipeline—meaning it can perform many advanced 3D functions, such as trilinear mip-mapping, without suffering performance hits. In fact, one of S3's highest priorities with the Savage3D was to add full-speed trilinear filtering to the mix, so a fair amount of silicon real estate is devoted to this purpose, triple the amount it would take to perform bilinear filtering at the same rate. This translates into an extreme 20% of logic in the 3D engine. While the architecture does support DirectX 6–friendly features such as anisotropic filtering, it will take a performance hit.

Other major features and performance claims include:

- ▶AGP 2.0 sidebands with DME or 33MHz PCI 2.1
- ▶5Mtriangles/sec Triangle Setup Engine
- ▶125Mpixels/sec trilinear fill rate
- ▶16- or 24-bit floating-point accurate Z-buffer (stored in frame buffer as 16/24-bit fixed)
- ▶Support for triangle strips and fans
- ▶Edge anti-aliasing with 4x oversampling
- ▶Specular lighting and diffuse shading
- ▶Alpha-blend modes
- ▶Void and Cluster dithering for 16-bit rendering
- ▶Support for up to 125MHz SGRAM (SDRAM also supported)
- ▶64-bit Synchronous Memory bus
- ▶2MB, 4MB, or 8MB maximum local video memory
- ▶60MHz VIP port
- ▶Hardware assisted features such as: bump-mapping, anisotropic filtering, shadows, texture morphing, reflection mapping, environment mapping, procedural textures

S3's biggest coup is that the Savage3D is the only forthcoming 3D accelerator to support Microsoft's DirectX 6 Texture Compression scheme in hardware. This is a no-brainer—after all, Microsoft licensed the compression technology from S3. Compression always reduces the size of the data, with the rate of compression fully adjustable. Up to a 5:1 compression ratio can be used, so 30MB of textures can be stashed onto 6MB of local video memory (in an 8MB configuration, including frame-buffer). With compression engaged, Savage3D can move more textures across the AGP bus per given clock cycle than any other videocard. This will



BENCHMARK MACHINE: Micron Millennia Xru with 300MHz Pentium II processor. 64MB of DRAM, Intel Atlanta 440LX ATX motherboard, Windows 98 final release with DirectX 6.0 beta.

DIRECT 3D BENCHMARKING

	SAVAGE3D	VOODOO² (SINGLE)	VOODOO² (DUAL SLI)
Forsaken Mark (800x600)	69.62fps	58.34fps	110.21fps
Forsaken Mark (1024x768)	69.62fps	failed	80.29fps
Turok (640x480)	61.6fps	64.5fps	73.9fps
Turok (800x600)	51.6fps	46.3fps	68.3fps

allow game developers to quit punking out with small 64x64-res textures, and bump those bad boys up to 256x256 and beyond, resulting in a more realistic 3D immersion. To comprehend the difference texture size makes, play *Quake II* (which relies on 64x64 textures) and *Unreal* (256x256-res and higher textures) and compare the two.

But compression is a double-edged sword. No matter how good your compression algorithm is, there's an inherent danger that visual quality could suffer. This will manifest itself as checkered patterns or washed-out colors on textures. This could be the weak chink in the Savage3D's armor. So S3 will allow enabling or disabling of texture compression via a control panel option.

Don't think all this talk of trilinear mip-maps and textures means Savage3D's 2D performance will be soft. On the contrary, its 2D heritage can be traced back to the 128-bit Trio3D chipset, with massive amounts of design and software optimizations heaped on top—nothing from the ViRGE era survives in Savage3D. RAMDACs can be pumped as high as 250MHz, so refresh rates at high resolutions shouldn't be an issue for 2D videophiles. 32-bit resolutions as high as 1600x1200 are expected. The architecture supports memory configurations up to 8MB of SGRAM/SDRAM. Whether this becomes a bottleneck as future games start to use higher color-rendering states and triple-buffering (which both require heaps of local videocard memory) remains to be seen. Software DVD is also high on the Savage3D's priority list, with MPEG-2 motion compensation (for lower CPU utilization) and a high-quality scalar in the mix for DVD junkies. For those who still wanna groove with a hardware DVD decoder, the Savage3D also allows a glueless interface.

Turok's first-person mayhem moves faster on S3's newest chip than on a solo Voodoo² board.

On the Savage3D, Forsaken at 1024x768 is also crisp, with the correct alpha-blends and colored lighting in place. Sparks and electricity rip through this enemy fighter.

The first vendor to announce plans to walk on the savage side is Hercules, with its Terminator Beast. Taking the design parameters to the max, the Terminator Beast will come with 8MB of local memory, a 250MHz RAMDAC, and TV outputs. STB, with its TV-output enabled Nitro 3200, and Diamond also plan on taming that Savage3D chipset.

At this year's Game Developers Conference, the Savage3D was out pixel-pumping 3Dfx's Voodoo² card under the *Turok: Dinosaur Hunter* benchmark, much to 3Dfx's chagrin. While the Voodoo-boyz claimed S3 wasn't using the native Glide version for the tests, S3 pointed to Glide's inability to run at 800x600, where the tests were being conducted.

To settle these arguments, we fired up a revision "A" 8MB Terminator Beast (a Savage3D reference design) in our 300MHz Pentium II benchmark machine, and under our controlled environment, proceeded to see who was the boss of whom.

Against a single Voodoo² board, the Savage3D flexed its polygon pectorals. While 640x480 remained a Voodoo² party, at 800x600, the Savage3D's power could not be denied, besting 3Dfx's silicon-heavy add-in board on the benchmarks we threw at it.

S3's worst enemy, despite this blatant display of 3D power, is itself and its patently limp ViRGE legacy. While the thought of being a "3D decelerator" is furthest from S3's mind, this negative moniker may linger in the hearts of many who've fallen victim to the ViRGE debacle. Only time will tell whether its bitter taste will disappear beneath a flood of texture-mapped polygons running at 60fps+.

Regardless, S3 is back, and it's most certainly on the attack.

—Andrew Sanchez

THE SPECS

BIOS
203-AGP v1.0 |

WIN95 DRIVERS
[redacted]

BUNDLE
Win95 Drivers | Real3D demos: VRCreator | Kinesub | Incoming | Planet Tours | Town | Realimation SDK | NetImmerse | Bat Cave | Digital Bayou | Space City | 3Deep | Game Bundle TBD

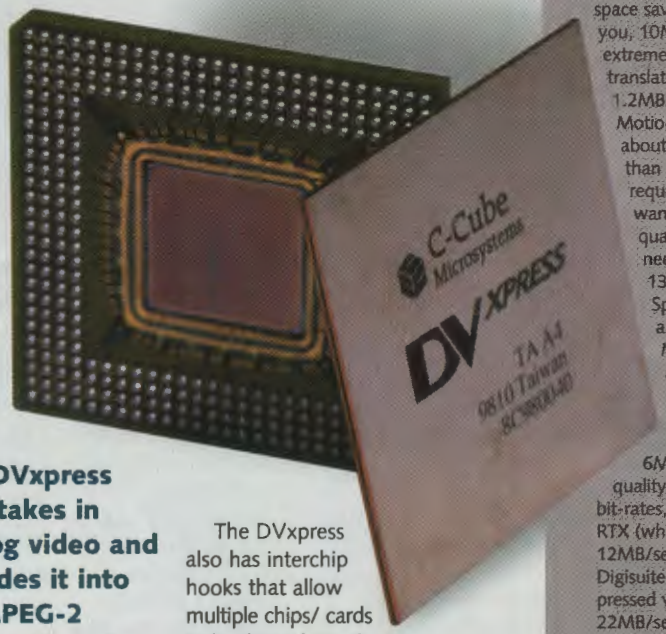
Available July 1998
Price $199
Company S3
Phone 408.588.8000
URL www.s3.com

C-Cube's DVxpress Chips

MPEG-2 video encoding on the cheap

Videotape is dead. Long live digital video.

C-Cube, manufacturer of MPEG-1 and -2 encoder/decoder chips, has recently developed the DVxpress, a new MPEG-2 (Motion Picture Experts Group) encoder/decoder chip that can handle two streams of video and a transition in realtime. What's more, it's cheap. In mere months, you'll find the chip on consumer-level capture boards allowing you to digitize all your home movies in the MPEG-2 format. Even better, these MPEG-2 movies can be burned to a DVD-RAM drive (see HiVal DVD-RAM drive preview on page 86) and played out to your television.



The DVxpress chip takes in analog video and encodes it into an MPEG-2 stream that can then be played back from consumer DVD-RAM drives.

C-Cube has two new chips targeted to MPEG-2 desktop video editors. The DVxpress 7112 is a single-chip MPEG-2 codec that operates at 100MHz, handles up to 50Mb (which will become a necessity when the new HDTV format arrives), and requires only 8MB of unified memory. The test board, Picard, is a PCI v2.1, half-length card that encodes/decodes MPEG-2 video to and from a composite or S-Video source at 720x480 (NTSC or PAL). C-Cube's second DVxpress chip, the 7110, gives you everything the 7112 offers, but maxes out at 15Mbps, doesn't support 4:2:2 color sampling, and doesn't give you dual-stream video output.

THE SPECS

VIDEO	
720x480	30fps
AUDIO	
Through sound card	
REQUIREMENTS	
Pentium 100MHz	
Win95	
16MB RAM 80MB HD	
RECOMMENDED	
A/V HD	
32MB RAM	

The proprietary PerfectView MPEG-2 compression algorithm features advanced multilayer motion estimation, improved error masking to eliminate common MPEG artifacts, and proprietary quality metrics to ensure optimal bit allocation for every picture. And the embedded digital signal processing (DSP) coprocessor performs roughly 1.6 billion arithmetic, pixel-level operations per second.

After evaluating DVxpress using the Picard board (a C-Cube reference design), we concluded that in the near future, all video cameras will have these types of chips embedded in them, capturing video directly to hard drives or DVD-Rs. Because C-Cube has brought all this technology onto one chip (it used to take more than 15 to accomplish the same tasks), expect to see entry-level consumer products for less than $1,000.

The DVxpress also has interchip hooks that allow multiple chips/ cards to be daisy chained to improve throughput for those who need to edit, say, two streams of HDTV-quality (100Mbps) video in realtime. And finally, the DVxpress chips include C-Cube's proprietary, frame-accurate MPEG editing (FAME). FAME lets users start, stop, seek, and scrub along the Intra, Predictive, or Bidirectional frames.

C-Cube expects the first products using its chip to ship around the end of the year and the IEEE 1394 version of the card to ship six months after that. So far, two companies have announced they will be developing products using the chip. Pinnacle Systems, which wouldn't reveal what it's working on, and Fast Electronic, which is working on a professional-caliber product called 601, a $15,000 frame-accurate, multistream editing and realtime special-effects card that should be available by Q4 this year.

We have yet to see a software editor that lets you cut and paste on IPB frames, and add transparent tracks, multiple layers/audio tracks, and transitions. But be assured that when someone does, we'll see a desktop-video revolution that will rival, if not exceed, the desktop-publishing revolution of the early 1990s.

—Rick Popko

Available Q4 1998
Price Depends on volume
Company C-Cube
Phone 408.944.6300
URL www.c-cube.com

THE 911 ON MPEG-2

What makes MPEG-2 special is its incredibly low bit-rate and high picture quality. To give you an idea of the substantial space savings MPEG-2 brings you, 10Mbps (which is extremely high quality) translates to roughly 1.2MB/sec of regular Motion-JPEG video (that's about one-third less space than IEEE 1394 video requires). Currently, if you want to encode high-quality digital video, you need to use either a IEEE 1394 card such as DPS's Spark (encodes video at a flat 3.6MB/sec) or a Motion-JPEG card such as Pinnacle Systems' miroVIDEO DC30+ (encodes between 5MB/sec and 6MB/sec). Broadcast-quality boards require higher bit-rates, such as Truevision's RTX (which requires roughly 12MB/sec) and Matrox's Digisuite (for truly uncompressed video, uses between 22MB/sec to 24MB/sec). Sustained data rates such as these require expensive and dedicated SCSI drive arrays. MPEG-2, on the other hand, only requires between 2Mbps and 10Mbps. And the picture quality is superb. MPEG-2 technology is used in products such as satellite TV receivers, video on demand, and set-top/computer-based DVD players.

The Picard board was designed by C-Cube to demonstrate what the chip is capable of. Expect similar-looking cards from Fast Electronic and Pinnacle Systems in the coming months.

HiVal DVD-RAM Kit

Write on!

The drive is SCSI-2 based and comes stock with a 2MB buffer. It uses a red (650nm) laser, a brushless spindle motor, and vibration-suppressing fluid bearing for high precision and low vibration.

We celebrated the day we received HiVal's pre-production Panasonic LF-D101 DVD-RAM drive, the same one that'll be in its DVD-RAM kit. DVD-RAM is a rewritable standard that can record up to 2.6GB of data per side and can play back DVD-ROM and DVD-Video media in addition to all existing CD formats.

HiVal's kit will include the drive, an Adaptec 2904 PCI SCSI host adapter, a piece of single-sided DVD-RAM media, recording software, a few movies, and at least one game. Optionally, you can also get Sigma Designs' EM8300 REALmagic Hollywood+ DVD/MPEG-2/MPEG-1 decoder board and a pair of high-frequency RF transmitters that allow the viewing of DVD movies on your television. They send a 2.4GHz WaveLink signal from your computer up to 300 feet to your TV and can penetrate up to five walls, floors, or ceilings. This frequency is far superior to current 900MHz phones and won't interfere with them or your garage door.

THE SPECS

INTERFACE
SCSI-2 (50-pin internal connector)
REQUIREMENTS
Pentium 133MHz or better
8MB of RAM (16 recommended)
SCSI Host Adapter
Free PCI slot for REALmagic card
RECOMMENDED
DVD-RAM, PD, DVD-ROM, DVD-R (Disc-at once), CD-ROM XA, CD-R, CD-RW (Variable Packets), CD-DA, Video CD, CD-EXTRA, PhotoCD Multisession

We tore into the drive as soon as it hit the lab. CD-ROM testing showed that it performed almost on par with its specs, spinning a disc at 20x. This drive reads CD-based media using CAV technology, so read potential doesn't occur until the drive head reaches the outer tracks, and the drive acts accordingly. It garnered a drive rating of 15.4x and read at 20x (2,955K/sec) on the outer tracks. Random seek was a sluggish 98ms, but remember, this is a pre-production drive and settings that affect scores such as these usually aren't tuned till just prior to shipping. CPU utilization (at 19x) was only 6%, which is expected in a SCSI-based drive. The drive reads DVD media using CLV technology so that data is delivered evenly across the whole disc. DVD Tach delivered a drive rating of 2.1x, an excellent score for this 2x-rated drive. 2,780K/sec of data was delivered across the whole disc. Random-access times came in at 100ms, and read bursts of up to 5K/sec were recorded.

Sigma Designs' EM8300 REALmagic Hollywood+ is a DVD decoder board that allows the playing of DVD-Video movies on your computer. The playback on this board was the sharpest picture we've ever seen on a computer monitor. This could very well be the kit to beat with regard to hardware DVD decoding.

Recording data onto the drive is not a fast process, though. Again, it may be due to this drive's pre-production status. Data was written to the disc at approximately 1.2K/sec. Real-world recording times are on par with 2x speed CD-R drives, where 650MB of data require about a half-hour. We used C-Cube's Picard reference board that utilizes the DVxpress encoding chip to record an MPEG-2 movie to a hard drive, and then recorded it onto DVD-RAM media (more info on the C-Cube board can be had in the preview on page 89). We then played the movie back on the drive hooked up to Sigma REALmagic Designs' Hollywood+ decoder, and it played back beautifully to both the monitor and a television.

The drive utilizes a unique front-loading tray in which the cartridge is inserted between two guide grooves. A single piece of DVD-ROM or CD media does not require a cartridge, though. It's inserted the same way and is guided by two slits located in the middle of the two guide grooves. HiVal's DVD-RAM kit should be available in all its various flavors by the time you read this.

—Sean Cleveland

PRICE $499 for drive and recording software; $699 for drive, software and DVD decoder board; $999 for drive, software, DVD decoder board, wireless WaveCom RF units
COMPANY HiVal
PHONE 714.953.3000
URL www.hival.com

WRITE DVD!

HiVal bundles Software Architects' Write DVD!, which includes a special device driver that allows for the reading and writing to DVD-RAM using the Universal Disk Format (UDF) file system or ISO 9660, the older CD-ROM file system. Files are added and removed dynamically, like a DOS FAT-based hard drive. UDF is far superior to ISO 9660 in that it supports Unicode characters used by other OSes, supports long filenames, and eliminates directory depth limitations. UDF also utilizes space more efficiently and is convenient for random reads and for streaming both audio and video.

Illustrator 8.0

The promise of a harmonic convergence

THE SPECS

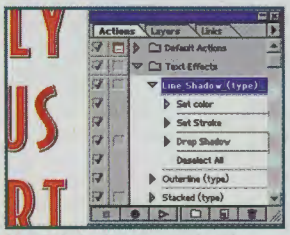
REQUIREMENTS
- Pentium
- Win95/98/NT
- 32MB RAM
- 50MB hard drive space
- 800x600 monitor resolution

RECOMMENDED
- 95MB hard drive space

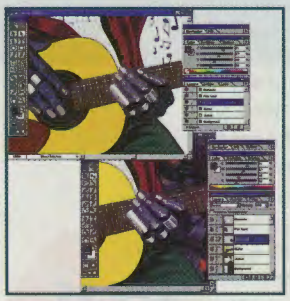
Short of making the inevitable merger of vector- and raster-based graphics apps, Adobe's latest update to the venerable *Illustrator* line promises another slew of tools that'll make the designer's job easier while opening creative doors.

Version 8.0 will catch the veteran app up with long-time competitor *FreeHand* (at least numerically). The revisions focus primarily on smoothing the program's historically steep learning curve, instead of ladling out new power tools for pro-caliber users.

One exception is the addition of the new gradient mesh tool. This unique feature creates previously impossible (or at least incredibly intricate) blends that smoothly transition multiple colors in multiple directions within a single vector object. Once created, these blends can be fully edited and easily repositioned. With the wide variety of applications this effect can be applied to, this tool promises the most impact of the new features.



No. This isn't a screenshot from Photoshop. This is the new action palette in Illustrator, which allows selective multiple undos.

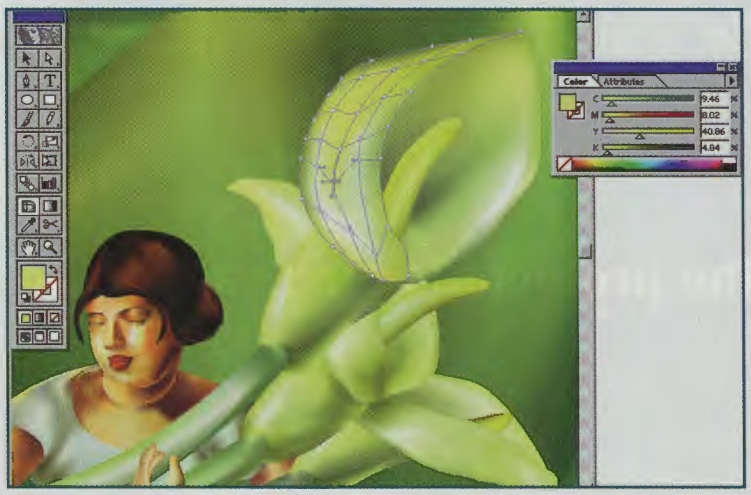


Running side-by-side, you'd be hard pressed to notice the difference between Adobe's graphics apps.

Other improvements to the program's blending capabilities will include the ability to automatically whip up blends along any path. The ensuing "live" blends can then be fully edited, including adding or removing anchor points and changing colors.

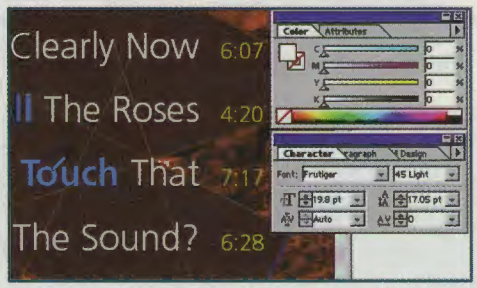
For those daunted by the traditional push-me-pull-you anchor-point controls of vector-based drawing, *Illustrator 8.0* will offer a new drawing tool that directly follows the cursor on-screen to create vector lines with no hassle. This pencil tool will be especially helpful to people with steady hands and/or tablet input devices.

Other intuitive tools will include a smoother that takes the kinks out of those shaky lines created by the pencil tool. Also included is an eraser for obliterating parts of a path or the whole damn thing, if you really screw it up. If you're in the ballpark with your new lines, try the Free Transform tool, which will bring scaling, skewing, rotation, and reflecting into a single pass.



Illustrator 8.0's new gradient mesh tool makes entirely new forms of art possible with the app.

The new Scatter Brush sprays selected art elements (such as leaves, snowflakes, or human entrails) along a path to create quick fills. The program will come with libraries of typical elements (sorry, no entrails are currently planned). This feature is reminiscent of classic graphics apps such as SuperPaint, but this new version is on some serious steroids, with control over size, spacing, and relative dispersion.



The new version of Illustrator continues to add text-handling tools, such as a dropper that samples text styling to apply elsewhere.

The bulk of additional changes can be grouped under the convergence of all Adobe products. While most of this transition falls under the interface banner, one of *Illustrator 8.0*'s most impressive new features looks to be the ability to export files into *Photoshop*—with layers intact. This major breakthrough could change the workflow of many designers.

Other integrations with the Adobe product line include adopted elements such as the Actions, Brushes, Links, and Navigator palettes. The Pathfinder commands have also migrated to a palette in the new world order. The Eyedropper and Paint Bucket tools treat colors as designers have come to expect in *Photoshop*.

While Adobe assures us that its customers don't want a product that merges the *Photoshop* and *Illustrator* realms (are those the same customers who didn't want *Image Ready*'s functionality in *Photoshop*?), the two seminal graphics apps share so many interface elements, tools, and file formats that the overhead of such a merger is approaching nil.

—Brad Dosland

Available Sept 1998
Price $375
Company Adobe
Phone 800.492.3623
URL www.adobe.com

Testing Policy

Our product evaluation process is built on down-and-dirty, hands-on testing. All hardware benchmarking is conducted in the Maximum PC lab by Maximum PC editors, and, whenever possible, we use real-world applications to gauge performance. Our final verdicts are based on benchmark results and a subjective appraisal of product features.

Real-World Benchmarking

Our benchmarking charts are simple: The farther right the bar reaches, the better the hardware performed. Here's the deal on specific benchmarks.

▶**CPU/MOTHERBOARD** Based on Symantec's System Information benchmark, the bootMark tests the CPU, its bus interface, memory, memory cache, and core-logic chipset. The final benchmark score is based on an arbitrary performance range.

▶**WINDOWS APPS** BAPCO's SYSmark32 uses task scripts in 13 popular productivity and content creation apps to test real-world performance. The benchmark also puts major stress on the videocard and driver, forcing it to draw complex screens in rapid succession. The final benchmark score is based on an arbitrary performance range.

▶**HARD DRIVE** HD Tach measures multi-threaded hard drive performance. We publish the average read score in megabytes per second.

▶**CD-ROM** CD Tach measures CD-ROM read times and CPU utilization. We publish the drive's cumulative speed rating (e.g., 24x).

▶**3D RENDERING** We use Newtek *Inspire3D* to gauge how fast the machine can complete a complex ray-traced rendering—a grueling test of the CPU's floating-point power. Final score is in total seconds from start to finish.

▶**DESKTOP PUBLISHING** In a scripted Adobe *Photoshop* test, we record how long it takes to apply various filters to a control image. A brutal test of the CPU, memory subsystem, and hard drive. Final score is in total seconds from start to finish.

▶**DIRECT3D** *Forsaken* is a space shooter rich in colored lighting, and alpha-blending. Tests the 3D accelerator (and Direct3D drivers), and the CPU's floating-point. Final score is in average frames per second at 800x600.

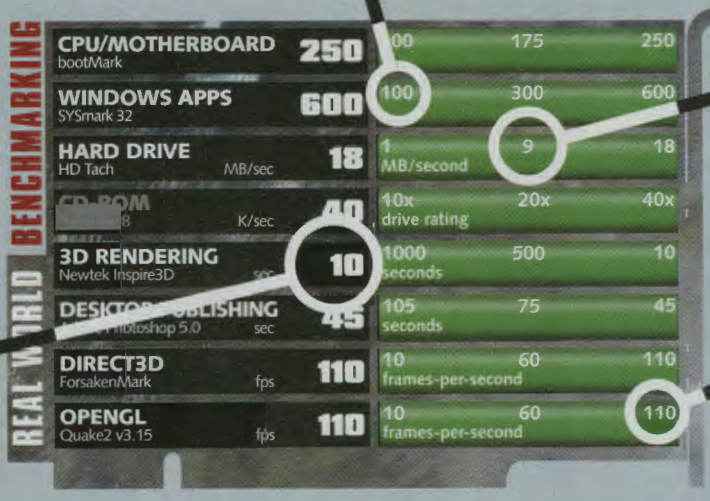
The lowest score possible. Any lower, and the performance (or lack thereof) doesn't even register on our radar.

▶**OPENGL** *Quake II* is a first-person shooter rich in complex polygons and all those nifty OpenGL special effects. Tests the 3D accelerator (along with its OpenGL drivers) and the CPU's floating-point. Final score is in average frames per second at 800x600.

▶**RAM SPEED** Stream for DOS 2.0 tests motherboard memory bandwidth in megabytes per second.

▶**AGP PERFORMANCE** Final Reality AGP is a Direct3D benchmark that uses 256x256, 16-bit textures to tax the motherboard's AGP bus. Final score is in average frames per second.

▶**BATTLEZONE** Another effects-intense Direct3D game. For videocard reviews, we run all three of our 3D gaming benchmarks at both 800x600 and 1024x768. Final scores are in average frames per second.



The mid-point denotes "acceptable performance"—or what obsessive power-users consider good but not great.

The specific score achieved by the product.

The zenith, the limit, the living end. The highest score we expect to see for a while.

REVIEWS

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

GUT SHOTS: FULL EXPOSURE, FULL DISCLOSURE
All system reviews feature large open case shots to give you a first-hand look at motherboard accessibility and expansion opportunities. And whenever possible, we show you the guts of individual components to illustrate what makes them tick.

EDITOR'S CHOICE AWARD:
Only 9 and 10 verdicts are even eligible for the coveted Kick Ass award, the mark of PC excellence.

THE SPECS: A roundup of system requirements and bundled hardware and software.

THE SPECS
- BIOS
- WIN95 DRIVERS
- BUNDLE
- BUNDLE

PLUSES, MINUSES: A quick summary for people who are too lazy to read the entire review.

PLUSES
Good Stuff

MINUSES
Bad Stuff

MAXIMUM PC VERDICT: Our final judgement, awarded on a ten-point scale. Often brutal, always fair.

MAXIMUM PC VERDICT

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5

In this issue

▶ HARDWARE

CTX K62 SAK300D 96
Diamond Stealth II G460 102
Hercules Terminator 2x/i 103
Real3D StarFighter PCI 103
Pionex 826010 106
Matrox Millennium G200 109
Iomega Jaz 2/Syquest SparQ 116
Kenwood TrueX 40x 118
AOpen CD-936E 36x 119
Sony CDU711 32x 119
Quantex QP6/400 SM-4X 122
Diamond Monster Sound MX200 126
Turtle Beach Montego A3DXstream . . .127
I/O Magic Magicwave PCI 127
Iomega Buz 129
Tektronix Phaser 560 131
Soyo SY-6BB 134
HP Pavilion 8290 136
Canon ZR 138
miroVIDEO DV300 139
Xircom RealPort Modem 144
Hayes Optima Modem 144

▶ SOFTWARE

Windows 98 98
Premiere 5.0 104
Photoshop 5.0 114
3D Studio Max 2.5 110
Poser 3 124
Goldmine 4.0 133
LapLink 7.5 133
Sonic Foundry's ACID 140
Autoscore Pro 2.0 141

▶ GAMING

Unreal 100
Descent Freespace: The Great War 128
X-Plane 142
X-Files: The Game 142
X-COM: Interceptor 142
Army Men 145
MechCommander 145
Spec Ops 145
Redneck Rampage Rides Again 146
Deer Hunter 146
Monster Truck Madness 2 147
Tribal Rage 147
Pro Bass Fishing 147
Final Fantasy VII 148

CTX SAK300D

K6-2 steamrolls Celeron, mostly

CTX has made a lean, mean lavender machine.

PLUSES

- Both composite and SVGA outputs on the Riva 128
- Four open PCI slots
- Great Microsoft Elite Natural Keyboard and IntelliMouse

MINUSES

- Redesigned Microsoft Elite Natural Keyboard
- No more memory slots

In the sub-, near-, and almost-$1,000 category, systems based on AMD's K6-2 rule the world. With the CTX SAK300D, it's easy to see why. Against Intel's most similar CPU to date, the 266MHz Celeron, AMD's K6-2 with 3DNow! whips butt using optimized drivers.

By going with a cheaper CPU, CTX was able to put some good components in this white and purple box, such as 64MB of SDRAM and Microsoft's IntelliMouse and Elite Natural Keyboard, which this time around is something both to praise and hock a lugey on. Microsoft kept the swept lines of its original ergo keyboard, but reduced the size of the cursor keys to near uselessness.

The SAK300D's performance in our *Photoshop* test shows where the RAM goes. Turning in a score of 137 sec, it whips through the hurdles in less than half the time of the Pionex Celeron (reviewed on page 106). The scales were balanced, however, in the *Inspire 3D test*. Although the K6-2 ticks along a full 34MHz faster than the Celeron and has secondary cache, the AMD's floating-point math skills are so poor it must have graduated from an urban public high school.

Don't let this scare you off if you intend to pound the SAK300D with business apps. It turned in an admirable 104 in the SYSmark 98 test, which runs a system through a gamut of leading productivity applications. Compare that to the HP Pavilion on page 136, a 400MHz Pentium II that could only crank out 132 in SYSmark 98.

But let's be real. People will buy this chip for its fancy 3D footwork. The K6-2 hammers out impressive numbers when 3DNow! is used. Although we had to disable sound to get the Direct3D performance test, *Forsaken*, to work properly, it whipped out a respectable 40.3fps at 800x600. With the optimized Riva 128 drivers, the score jumped to 54.4fps. Even with sound disabled, it's still impressive when compared to the 58fps a 400MHz Pentium II with an august Voodoo² card pulls down.

The machine puked when we fed it *Quake II*, however. With the only optimized drivers available from nVidia's web site corrupt at the source, we had to run it in standard OpenGL mode for a weak 19.5fps. That may be the lesson here for people looking for cheap 3D gaming power: Stay on top of driver updates and tweaks coming from AMD or your videocard maker. The CTX itself didn't come with the 3Dnow! drivers installed.

Where was the CTX found wanting? A faster hard drive with more capacity would be appreciated. The Fujitsu 6.4GB is the bare minimum you'd want in a hard drive these days. You also give up expandability in RAM with both slots filled. And since the SAK300D doesn't include a monitor, you'll have to spend another $200 for a postage-stamp-sized 15-inch monitor. The software bundle is light on the productivity side. We would have preferred a full-featured office suite.

These warts aside, the SAK300D is a great tweaker's machine with enough performance for gramps or a college-bound student.

—Gordon Ung

UNDER THE HOOD

THE BRAINS	
CPU	AMD K6-2 with 3DNow!
L2 Cache	512KB
RAM	64MB SDRAM
Motherboard	BIOSTAR M5ALA, ALI1643 chipset
Drive Bays	Three 5.25-inch, two 3.5-inch
I/O Ports	Two USB, two serial, one parallel, one gameport
DISPLAY	
Videocard	Riva 128 with 4MB and composite and SVGA video-out
Monitor	None
Res/Refresh	N/A
STORAGE	
I/O	EIDE on motherboard
Hard Drive	Fujitsu MPB3064AT 6.4GBB
CD/DVD	Lite-On LTN-301 32x max drive
Removable	1.44MB floppy
SOUND	
Sound	ESS-1869-based ISA soundcard
Speakers	DAI HWA, SCTX-80
THE BUNDLE	
Microsoft Money I Works I Encarta 98 I Expedia Trip Planner 98 I My Personal Tutor I CART I Windows 98	

BOOT 0:54 DOWN 0:04

MAXIMUM PC VERDICT

Price $999
Company CTX
Phone 800.742.5289
URL www.ctxcomputers.com

8

REAL WORLD BENCHMARKING

CPU/MOTHERBOARD bootMark		126
WINDOWS APPS SYSmark 32		104
HARD DRIVE HD Tach	MB/sec	8.1
CD-ROM CD Tach98	K/sec	22.6
3D RENDERING Newtek Inspire3D	sec	1052
DESKTOP PUBLISHING Adobe Photoshop 5.0	sec	137
DIRECT3D ForsakenMark	fps	40.3
OPENGL Quake2 v3.15	fps	19.5

Minor Curse
How much money did Microsoft save making the cursor keys so small on the Elite keyboard?

EXPANSION NOTES

For a 1K machine, the CTX gives you four open PCI slots to break your bank account on. You'll also have room for one external 5.25-inch bay and two 3.5-inch bays. And CTX wisely throws in a well-written motherboard manual.

EXPANSION MAP

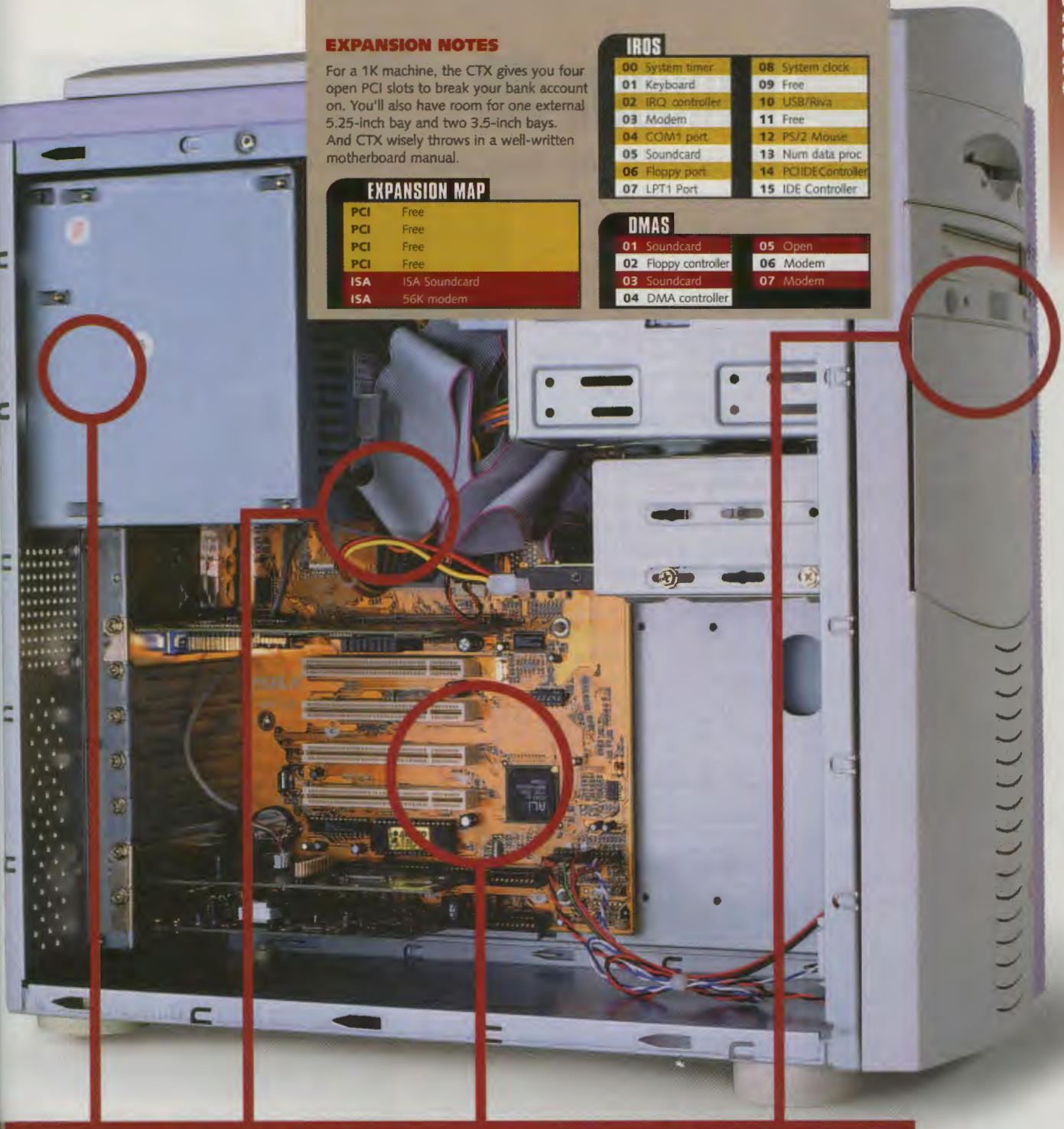
PCI	Free
PCI	Free
PCI	Free
PCI	Free
ISA	ISA Soundcard
ISA	56K modem

IRQS

00	System timer	08	System clock
01	Keyboard	09	Free
02	IRQ controller	10	USB/Riva
03	Modem	11	Free
04	COM1 port	12	PS/2 Mouse
05	Soundcard	13	Num data proc
06	Floppy port	14	PCI IDE Controller
07	LPT1 Port	15	IDE Controller

DMAS

01	Soundcard	05	Open
02	Floppy controller	06	Modem
03	Soundcard	07	Modem
04	DMA controller		



Socket 7 Challenge Hidden under this cool blue fan is AMD's throw down to Intel.

No Vacancy You'll have to live with 64MB of RAM unless you toss out one of the DIMMs.

Lavender and Lace It's not what's outside that matters. It's what's inside. The CTX dances circles around the Intel offerings in its price range in most tests, but its weak math scores may send you to remedial school.

Tiny fingers Better keep those nails sharp and long to reach the volume controls for the CD-ROM headphone jack. But wait, where's the headphone jack?

Windows 98

We waited this long for a service release?

With no earth-shattering new features, the latest revision of Windows, Windows 98, sells itself merely as a spit-shined version of Windows 95. Beyond minor performance tweaks and better system utilities, little has been done in Win98 to change the way Win95 does things. In fact, without the much-hyped web integration, Windows 98 would otherwise be a minor service release that cleans up the code a little and adds a few new features.

The Win98 Program Guide (a component of WebTV) takes watching TV on your PC to a new level, especially when combined with program broadcasts with interactive content

The underlying system architecture is the same hodge-podge of 16- and 32-bit kernel thunks found in Win95, although performance tweaks to memory management, boot-up and shutdown sequences, and program launching address many of the OS's shortcomings. In Win98 some intelligence is finally applied to memory management, with the OS attempting to anticipate when memory needs to be swapped to your hard drive instead of letting it page willy-nilly, causing the notorious shuddering effect seen in performance-intensive games and apps. Win98 also brings a notable decrease to its boot-up time by initializing devices as needed instead of all at once as the OS is loading, and speeds the shutdown process by powering down without unloading device drivers.

WHAT YOU NEED

86DX/66 or higher
16MB RAM
Between 120 and 295MB hard disk space
CD or DVD drive
14.4 modem (for Internet access)

Windows 98 uses two methods to reduce application load times. One pre-aligns executables so that they can be mapped directly from the disk cache into memory, bypassing the need to copy them into a separate aligned memory space. The second monitors how an application launches, recording both the order in which all the app's support files are loaded and their physical locations. It passes this information to Disk Defragmenter, which uses it to place the files in sequential order on your hard drive according to how the application loads them.

While all these seem to add up to some pretty hefty OS modifications, you'll notice only modest speed improvements, as shown in Figure 1. Without restructuring key kernel processes, speeding up Windows is similar to lighting a fire under an elephant's butt.

The real reason most of us will upgrade to Windows 98 is integrated support for all the advanced hardware that was merely a gleam in some engineer's eye when Windows 95 was first launched. All the acronyms that populate the hardware lists of new PCs (such as AGP, USB, DVD, and FireWire) will find a happy home in Win98's expanded driver library. Making its debut in Win98 is Microsoft's new Win32 Driver Model, which allows drivers (video drivers are the notable exception) written for NT to work in Win98. Multiple-monitor support finally makes it to the Windows platform, in addition to advanced power management features so new that we don't have a system to test them on.

SPEEDING UP LAUNCH TIMES

	WIN95	WIN98
boot-up time	0:52	0:42
shutdown time	0:28	0:15
APPLICATIONS		
Outlook 98	0:07	0:07
Word 97	0:06	0:05
Excel 97	0:05	0:04
Photoshop 4.0	0:13	0:13
DeBabelizer Pro 4.5	0:13	0:13
Navigator 4.04	0:14	0:14
Internet Explorer 4.01	0:08	0:08
Sound Forge	0:10	0:10
GAMING		
Quake II 3.15*	0:47	0:44
Starcraft	0:19	0:18
Heavy Gear**	0:26	0:24

*(time includes loading first demo) **(skipping intro movie)

The Win98 values were taken after running the OS for two weeks nonstop: applications were tuned on a weekly basis, and the hard drive was scanned, cleaned, and defragged every night.

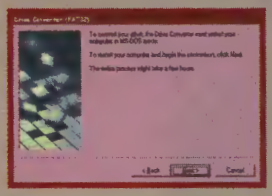
UPGRADING TO FAT32

Initially introduced in OSR2, FAT32 makes more efficient use of larger hard drives by using 4K cluster sizes and supporting partitions larger than 2GB. FAT32 plays an important role in Win98 when used in conjunction with both the executable alignment utility and the newly improved defrag, since Window's virtual-memory manager utilizes the 4K clusters more efficiently.

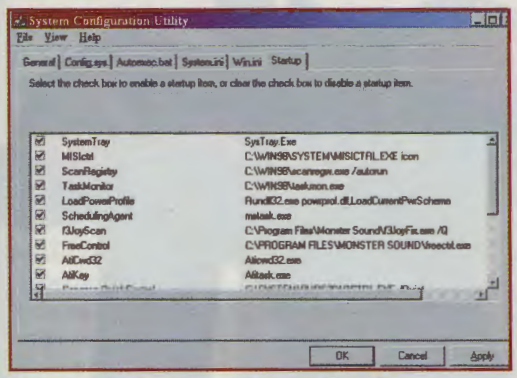
While OSR2 restricted the creation of FAT32 partitions to the FDISK utility that wiped all data from your hard drive, Win98 provides a handy wizard that walks you through a safe and sane upgrade process.

After starting the wizard and selecting the drive, the FAT32 converter will check for any incompatible programs and prompt for their removal if the incompatibility is severe enough. On one of our test systems, the FAT32 converter wouldn't complete the process because it detected System Commander modifications to the boot sector of the drive.

The next step prompts you to back up the contents of the drive to be converted, which isn't a bad idea, since conversion to FAT32 is a one-way process. If you ever decide to uninstall Win98 or set up a dual boot into NT (which doesn't read FAT32 drives), then an old-fashioned FDISK is the only way to switch the drive back to FAT16.



The real work of the FAT32 converter is done by the DOS executable CVT.EXE that's called after the Wizard restarts the system in DOS mode. After CVT.EXE works its magic, the PC is rebooted and the newly converted partition is defragged as soon as Windows loads.



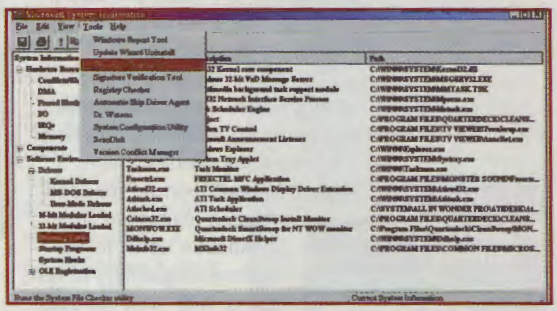
The System Configuration utility centralizes all your configuration files for editing and backup and gives you the option to modify what's run at startup.

If you have a TV-tuner card, you can run Microsoft's WebTV, although it may be a while before your cable company pipes the correct data for WebTV's more advanced features. And if you haven't experienced the wonders of the new FAT32 file system, a new wizard makes it easy to upgrade.

Microsoft has been offering *Internet Explorer* for free the past few years, and it's come time to start paying for it, with Win98 serving as the vehicle that delivers the Internet the Microsoft way. While web integration is Win98's most talked about feature, it definitely falls on the short list for those of us who want to maximize our PC's performance. Yes, there is a general system slowdown brought on through the integration of *Internet Explorer*, and no you can't separate it from the OS. Win98 opens new windows as web pages by default and slaps the Channel Bar in the middle of your desktop when it first opens, but they're easy to turn off when you want to go back to Windows as usual. By far the most useful application of Win98's web integration is the browsable help system.

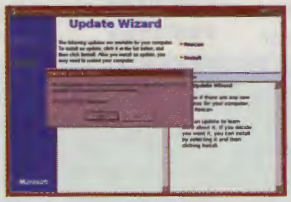
Apps still crash under Win98, and system lockups and the blue screen of death still threaten the Windows user, but an impressive set of utilities have been added to help keep everything in line. A new Registry Checker scans and backs up the Registry on boot up. If it detects a corruption, it restores the Registry from the most recent of five compressed backup copies. System File Checker performs the same operation for system files, keeping a log of changes and offering to restore originals when it detects a corruption or different version. As new software is installed, the Version Conflict Manager backs up old system files that are overwritten by new ones.

A beefed up Dr. Watson returns in Win98 to record and diagnose program crashes, and the new System Configuration utility all but replaces Sysedit as a convenient place to modify and backup your configuration files. These new system tools launch from the newly remodeled System Information utility, which is itself an excellent storehouse of all the nasty little details about your PC that lie buried in the Registry, such as hardware resources and conflicts, device driver particulars, and currently loaded system modules.



The System Information utility displays a comprehensive listing of what's running in your OS, and serves as a launching point for other system tools.

The Win98 Explorer now allows you to do other things while it copies or moves data around.



The Win98 Update Wizard connects you to Microsoft's web site and searches for updates, patches, and new drivers.

With few innovations, Win98's saving grace is support for more hardware than any other OS on the planet and a strong ability to repair itself. Windows 98 isn't the OS for the next millennium, but it will certainly get you by for a couple more years.

—Sean Downey

PLUSES

- Many bug fixes
- Applications load faster
- Fully supports FAT32
- Native USB and FireWire support
- Multiple monitor support
- Better multitasking in Windows Explorer

MINUSES

- $90 for a glorified patch?
- Same old Win95 architecture
- Internet Explorer slows things down
- No FAT32 to FAT16 conversion

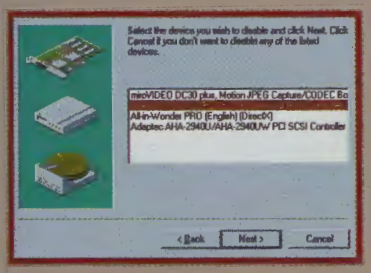
MAXIMUM PC VERDICT

PRICE $189 full, $90 upgrade
COMPANY Microsoft
PHONE 800.426.9400
URL www.microsoft.com

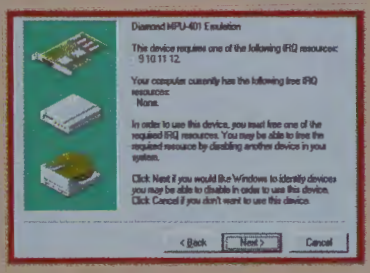
6

HARDWARE TROUBLESHOOTING WIZARD

Despite plug-and-play (or perhaps because of it), solving hardware conflicts has always been a chore in Windows 95. Along with allowing better access to device information through tools such as the System Information utility, Windows 98 adds a newly improved Hardware Troubleshooting Wizard to help guide you through the process.



The Wizard that walks you through the problem is launched from the conflicting hardware's device properties.



It informs you of what resources are required, what are available, and what can be done about it.

In this case the wizard gives you the option to disable another device in order to free up the required IRQ.

Unreal

And on the eighth day...

God created the world in seven days. It took Epic MegaGames a wee-bit longer to complete its first-person shooter, *Unreal*. But after delays galore, it finally walks the earth, bringing with it visual perfection that defies description.

There's no denying *Unreal*'s technical prowess. From the moment you wake up inside the bowels of the prison ship Vortex Rikers, it shines. *Unreal*'s texture-mapped polygon realms are visual stimulation taken to the extreme (regardless of renderer), with well-executed special effects, including coronas surrounding light sources, colored lighting, rotating brushes, reflective mapping, volumetric fogging, and more. The ensuing graphical orgy will make the most jaded gamer feel funny below the belt. Stars peek through billowing semi-transparent cloud cover, alien vistas and darkened corridors reveal themselves without a hint of pixelation or distortion. The water looks so real you'll be reaching for a towel, thanks to algorithmic procedure texturing, which makes for non-repeating animation (Epic also used this type of texturing with flame effects). The Unreal engine is capable of handling up to a whopping 4096x4096 resolution texture, but 16x16 up to 512x512-pixel texture maps will be the norm—much crispier than *Quake II*'s 64x64 maps.

THE SPECS

CPU EXTENSION SUPPORT
MMX
3DNow!
3D ACCELERATION SUPPORT
3Dfx Glide
PowerVR PowerSGL
3D SOUND SUPPORT
Aureal A3D
MULTIPLAYER
TCP/IP
IPX

PLUSES

- The best graphics ever for a first-person shooter
- Awesome scenery rendering
- Great one-player experience
- Lots of fun new tricks
- Cool portal technology for multiplayer
- Excellent software renderer

MINUSES

- Phat system requirements—P-II or K6 2 with 3D acceleration and lotsa memory
- No Open GL or D3D
- Multiplayer mayhem is uninspiring
- Some animation looks hokey

Feed this big bully a belly-full of laser blast... and notice the drop-dead gorgeous lighting effects.

The keyframe-animated models average about 450 polys, although some of the smoothly modeled beasties, such as the rasta-Predator-inspired Skaarj, venture into the 600 range. The ethereal soundtrack, accelerated via A3D, adds to the experience.

The one unfortunate byproduct of all this visual excellence is you'll need quite the über-computer to get framerates up to snuff. The minimum requirements listed on the box are a joke—realistically, you should have at least a 200MHz Pentium or 233MHz Pentium II with a phat 3D accelerator in tow (currently only 3Dfx and PowerVR are supported; OpenGL and Direct3D are in the works). While the software renderer is one of the prettiest out there, you won't get the full immersion you deserve without a supported accelerator sitting in your PCI slot. Some PowerVR/PowerSGL specific special effects include vertex lighting, which simulates more realistic lighting and shadow casting. Unfortunately, you loose some volumetric fogging in the 3Dfx and software versions.

High-res textures make almost everything in Unreal a wonder to behold.

On the performance tip, you can expect smooth framerates in the high 40s on a high-end system, but even the mightiest dual SLI system bogs down when too many objects and textures hit the screen. But the character animation looks a

Unreal's alien world is filled with a host of alien brutes who wanna see you dead-show 'em what ya got!

bit weak, especially the human characters. And, the occasional clipping problem and light coronas shining through objects hamper the immersion.

Unreal packs in all the programmability and extensibility *Quake* did, so expect tons of conversions, skins, and levels to appear in no time (thanks in large part to the included free level editor).

Navigating the indoor/outdoor levels that make up Unreal leads to the occasional hot foot.

As a single-player experience, *Unreal* is immersive, but derivative. Despite the fancy futuristic locales and exotic weaponry, gameplay still revolves around finding the switch and moving ever forwards, killing almost everything in your path—we say almost because some characters in the game actually help you. Storytelling is done via your universal translator's monochrome LCD display. It worked in *System Shock*, but not here. The much-vaunted AI is in full effect, with enemies circle-strafing, dodging, and even leading its shots, especially when you go up against the computer-controlled Bots.

There are nouveaux nuances here and there—dashing has been incorporated into normal movement, and the variable-mode weapon attacks come in handy for mixing up attack styles. Where *Unreal* loses its luster is during multiplayer. Despite all the technological advancements, including portal technology (which allows for linkable servers) and web launching, going toe-to-toe against a warm body isn't exciting. Even the ability to play dead during deathmatches couldn't tear death-dealing *Maximum PC* editors from their beloved *Quake II*. But new gameplay modes, such as the flashlit Dark Matches, are cool compensation. Epic MegaGames is busy getting those proverbial patches up to address multiplayer problems.

Unreal is an awesome technology that hints at greater glory and, with its solid single-player experience, is a worthwhile indulgence.

—Andrew Sanchez

MAXIMUM PC VERDICT

Price $50
Developer Epic MegaGames
Publisher GT Interactive
Phone 800.469.5961
URL www.gtinteractive.com

9

What's the point of a game being 3D if it doesn't employ any perspective? Unreal delivers.

OPTIMIZING YOUR UNREAL EXPERIENCE

Coaxing playable framerates out of *Unreal* can be vexing. Even if you think your system's pimped out to the max, *Unreal* has a habit of showing you how small your pixel-pumping muscle truly is.

Here are some tips for getting *Unreal* as silky-smooth as possible.

▶ **Adjusting Visual Quality**
Unreal is a memory-intensive application. With the amount of textures used in a given level for monsters and terrain, framerates stutter when the game starts to access the hard drive for virtual memory. The easiest way to keep *Unreal* from doing this is to set the texture resolution to low, which cuts the texture sizes used throughout the game in half (512x512 becomes 256x256, etc.), cutting memory storage requirements in half, as well. To do this, go to the Audio/Video option in the main menu, highlight the Texture Detail option, and set it to low.

In the main menu, choose Advanced options. This will open the following small window outside of Unreal.

▶ **Adjusting Cache**
Unreal reserves a chunk of system memory for all its resources, including sound, textures, and so forth. By default, it is set to 2MB. Increasing this setting lessens the chance of your OS using virtual memory, thus causing stuttering and slow framerates. To do this, go the Options menu.

▶ **Using the Flush command**
If your playing experience starts stuttering in areas you've already traversed, flushing the game's internal cache may help. To do this, pull down the console by pressing the tilde key (~). At the console, type in FLUSH and hit enter.

For more tweaks and tricks, go to www.unreal.org.

The i740's Last Hurrah

All eyes on i

In an age of dithered textures and unsightly seams, the i740—2D/3D graphics chip love-child of Real3D, Chips and Technologies, and Intel—set a new level of 3D visual excellence.

This 64-bit video processor, released earlier this year, comes chock-full of features, including a 32-bit floating-point setup engine, parallel processing of polygons, per-pixel mip-mapping, as well as all your favorite 3D visual features, such as bilinear filtering, and more. Direct3D is its forte, but with the proper drivers, i740 can do the OpenGL fandango as well.

i740's split-memory architecture relies exclusively on system memory for texture storage via AGP 2x with sidebands processing—any local memory on the videocard is locked down for 16-bit frame-buffer/Z-buffer duties. Some critics claim i740's reliance on system memory for texture storage and execution is a performance hindrance. But under our application-based benchmarks, we've seen the i740 outperform local-memory videocards.

Make sure your system can handle a full AGP 2x implementation, as many early Socket 7 AGP boards based on VIA's VP3 core-logic AGPset have problems with this architecture.

Six months is a long time in the 3D accelerator world, and with newer, faster, feature-rich 2D/3D architectures from S3 (previewed on page 86), 3Dfx, Number Nine, and others coming out later this year, the i740's days of glory are short. The Matrox MGA-G200 (reviewed on page 105) is already surpassing the i740 in features and performance.

—Andrew Sanchez

Diamond Stealth II G460

PLUSES
- Inexpensive AGP 2x board
- 8MB of SDRAM
- Kewl bundle
- Goes to 1280x1024@24-bit color depths

MINUSES
- Slow 203Hz RAMDAC
- SDRAM instead of faster SGRAM
- Refresh rates will not get 2D aficionados excited
- Performance is below other i740 parts

Hercules Terminator 2x/i

PLUSES
- Inexpensive AGP 2x card
- Faster 230MHz RAMDAC
- Edged out G460 in D3D tests

MINUSES
- Lower 2D resolutions
- SDRAM instead of SGRAM
- Refresh rates will turn off 2D-aholics
- 2D display is not as crisp as other cards at same refresh rate
- Driver problems caused visual glitches

Real3D StarFighter PCI

PLUSES
- AGP 2x performance on the PCI bus
- Gobs of texture memory (16MB)
- Play high-res textured games on older systems
- Drivers include mip-map adjustments
- Great visual quality

MINUSES
- All that memory drives up price
- Not as fast as other PCI videocards
- Steep price

Diamond Stealth II G460

Sporting 8MB of nonupgradable 100MHz SDRAM, the Diamond Stealth II G460's low-profile NLX-ready PCB includes dual VESA Media Interfaces for easy interfacing to Diamond's MPEG-2 daughterboard.

The low price means sacrifices. Don't expect TV ins or outs (none of these cards have 'em). Slower SDRAM and 203MHz RAMDAC are also signs of corner cutting (the StarFighter uses faster SGRAM and a 220MHz RAMDAC). Faster RAMDAC means higher refresh rates and cleaner and crisper video signals.

On the performance tip, the Stealth II G460 came up short—at 800x600 *Forsaken*, the G460 scored 32.27fps—a full 9.7 frames slower than the StarFighter AGP. With the proper ICDs in place, the G460 pushed through *Quake II* smoothly, although anything past 800x600 isn't recommended for speed freaks.

OpenGL ICD drivers for Diamond's Stealth II will get you Quake-ing in no time.

Visual quality remains top-notch, with no stray pixel or warped texture in sight. But there is some banding visible in the cloud cover. Also, there's no mip-map quality adjustment on the control panel.

THE SPECS

MAX 24-BIT RES/REFRESH RATE	1280x1024/60Hz
MAX 16-BIT RES/REFRESH RATE	1280x1024/85Hz
VESA 2.0 COMPLIANT?	YES
AGP?/LEVEL	YES/2x
AGP DIRECT MEMORY EXECUTION?	YES
BUNDLE	Win95 and NT 4.0 drivers | Incoming | Fremont 3D Data Visualization | World View Professional | MGI Photosuite SE | Adobe Acrobat Reader | Internet Explorer | Backweb

REAL WORLD BENCHMARKING

FORSAKEN	800x600 fps	32.3
FORSAKEN	1024x768 fps	26.2
BATTLEZONE	800x600 fps	35.0
BATTLEZONE	1024x768 fps	22.5
QUAKE II	800x600 fps	25.8
QUAKE II	1024x768 fps	15.8

MAXIMUM PC VERDICT

Price $99
Company Diamond Multimedia
Phone 800.468.5846
URL www.diamondmm.com

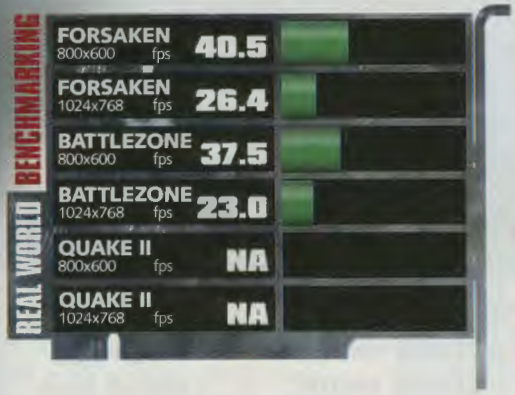
6

VISUAL QUALITY

Hercules Terminator 2x/i

The Terminator 2x/i follows the G460 closely in specs, with its 8MB of nonupgradable 100MHz SDRAM, although Hercules opted for a full-sized ATX-compliant PCB. It also tossed in a 230MHz DAC for 2D and twin VESA Media Interfaces for hooking up an MPEG-2 daughterboard.

Apart from the Touch controls, Hercules used standard i740 drivers, with no mip-mapping adjustment whatsoever.



Under the gun, performance is a mix of diggable benchmarks and weird driver issues. At 800x600 *Forsaken*, the Terminator 2x/i punched in a full 8fps faster than the Stealth II. Otherwise, it was neck-and-neck with Diamond's offerings.

It's a solidly built board, but the Hercules Terminator 2x/i suffers from some weird driver issues.

Hercules did not have OpenGL ICD drivers ready at press time. But, under Microsoft's *Baseball 3D 98* at 1024x768, weird smeared textures appeared. And despite the faster RAMDAC, visual quality is fuzzy, even at the maximum 85Hz refresh rate.

Hercules needs to work these driver issues out before we can recommend the 2x/i.

THE SPECS

MAX 24-BIT RES/REFRESH RATE	1024x768/85Hz
MAX 16-BIT RES/REFRESH RATE	1028x1024/75Hz
VESA 2.0 COMPLIANT?	YES
AGP?/LEVEL	YES/2x
AGP DIRECT MEMORY EXECUTION?	YES
BUNDLE	Win95/NT 4.0 drivers

MAXIMUM PC VERDICT

Price $99
Company Hercules
Phone 510.623.6030
URL www.hercules.com

4

Real3D StarFighter PCI

With its 220MHz RAMDAC, the StarFighter PCI comes with a whopping 24MB of total video memory—dual 4MB SGRAM chips locked in as a dedicated buffer. Thanks to the PCI-to-AGP bridge controller chip located on the PCB, the remaining 16MB of SDRAM (split up into four 4MB chips) tricks the i740 into thinking it's system memory on an AGP slot.

Complete with mip-mapping adjustments and OpenGL ICD, the StarFighter PCI fought to keep up with its true AGP 2x cousins. And while it bests the Stealth II G460 at 800x600, it faltered at 1024x768. But Real3D was the only board in this roundup to have OpenGL ICD. 19.5fps at 800x600 *Quake II* isn't exactly mind-numbing, but visual quality is as sharp as ever.

The StarFighter PCI should may not be as fast as boards based on nVidia's Riva 128 chipset, but aren't a few frames-per-second worth better visual quality?

The only board to come with OpenGL ICD, Real3D's StarFighter PCI can kick down AGP texture storage on your PCI-bound system.

THE SPECS

MAX 24-BIT RES/REFRESH RATE	1280x1024/85Hz
MAX 16-BIT RES/REFRESH RATE	1280x1024/85Hz
VESA 2.0 COMPLIANT?	YES
AGP? LEVEL	NO * simulates AGP 2.0 spec via large, onboard secondary memory bank
AGP DIRECT MEMORY EXECUTION?	NO * simulates AGP 2.0 spec via large, onboard secondary memory bank
BUNDLE	Wing Commander Prophecy SE I Daytona USA I Redline Racer I TrueSpace 3 SE I Real3D demos

MAXIMUM PC VERDICT

Price $229
Company Real3D
Phone 800.393.7730
URL www.real3d.com

7

Premiere 5.0

Home video editing gone pro

Two years ago, *Premiere 4.2* had some issues when it came to pro-caliber production. *Premiere 5.0* leaves no doubt that Adobe is hunting the professional market—and loaded for bear.

Installation (including QuickTime 3.0) was a breeze, and *Premiere* automatically detected and set up our Perception professional videocard.

Premiere's interface has morphed into the best of in:sync's *Speed Razor 4.0* and Avid's *Xpress 2.0*, while keeping the best of *Premiere 4.2*. You'll spend most of your edit time in the Monitor window, which resembles an *Avid*-style editor (with the clip view and the timeline view side by side). The monitor window easily accommodates three-point editing (fitting a clip into a hole), simple insert, preview, trim and control of clips, and the project timeline.

Version 5.0 uses four tabbed palettes (similar to *Photoshop*): Commands is similar to Actions for repeated shortcuts; Transitions is an easily customized collection of transitions; Navigator quickly locates work areas of the timeline; and Info quickly delivers the complete goods on a clip. Palettes can be joined up or torn off and used independently. 5.0 also features a revised set of editable keyboard shortcuts.

The new Timeline window (where the project is displayed) simplifies the addition, deletion, naming, targeting, hiding, displaying, and editing of tracks. The timeline, which allows up to 99 tracks of audio and 99 tracks of video, now displays tracks from the top down (similar to how *After Effects* and *Photoshop* handle layers). Adding greatly to *Premiere*'s flexibility, tracks can be individually named, targeted, collapsed, made shy, locked, or excluded. *Premiere*'s extensive set of video filters is accessible by simply right-clicking on a clip in the timeline.

The Project (formerly known as bins) window stores your audio and video clips. Individual clips can be displayed as picons (picture icons), thumbnails, or as a simple list. The amount of information displayed is easily customized, and bins can be searched and sorted any way imaginable. The 11 database fields and four user-defined fields can contain up to

Premiere's timeline has been revamped to closely mirror professional-level editors like in:sync's Speed Razor 4.0 and Avid's Xpress 2.0.

THE SPECS

REQUIREMENTS

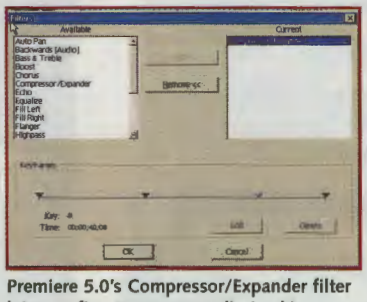
- Intel Pentium Processor
- Windows 95 or later, or NT 4.0
- 32MB RAM
- 60MB of hard disk space for installation

PLUSES

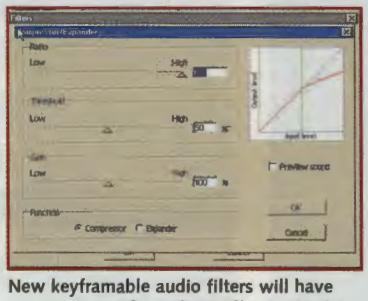
- Enhanced audio capabilities
- Redesigned monitor window
- Automatic scroll and crawl feature
- Direct access to Perception card
- Compatibility with realtime cards
- Enhanced hardware (deck) control

MINUSES

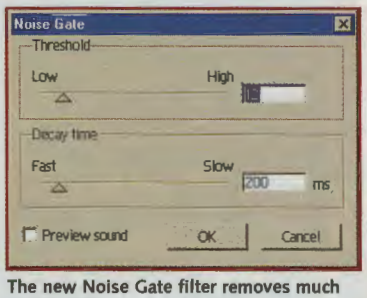
- Cannot view capture video in monitor window
- Cannot resize the monitor or play windows
- Only one project can be open at a time
- Deck control and batch recapture are buggy



Premiere 5.0's Compressor/Expander filter lets you fine-tune your audio track's dynamic range.



New keyframable audio filters will have you mixing and matching effects into the wee hours of the morning.



The new Noise Gate filter removes much of the background noise during quiet passages of an audio clip.

32K of text. Obviously, this is helpful for long-form projects. In fact, clips can even be moved directly to the timeline en masse in the bin order, by selecting and dragging them. You can also move any number of clips to the "monitor" window, to speed trimming of several clips.

Adobe's finally fixed the 29.97 sync issue, making this application suitable to broadcast editors.

On long-form projects, users can now create movies up to three hours long. Even more significant and along the same lines, Adobe has fixed the sync-timing problem that's plagued the application for years. In previous versions, when making broadcast movies using the industry-standard 29.97fps, audio and video would drift out of sync after only a few minutes. This caused serious broadcast professionals to abandon *Premiere* and move to higher end editors such as Avid's *Xpress*.

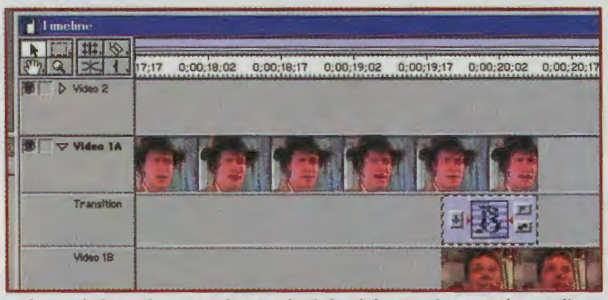
Other video improvements include 32 levels of undo, which should encourage experimentation, more powerful titling, superior long-format editing capability, support for true lip-sync, and slip-and-slide editing tools. You can now import *Photoshop* layers individually, as well as simplified drag-and-drop capabilities with *After Effects* and *Illustrator*. Most *Premiere* files, such as EDLs, titles, motion graphics, storyboards, mattes, and so on, can be exchanged across platforms, but these don't include the actual digitized clips.

If you're as serious about your audio as you are about your video, you should check out *Premiere*'s 14 new audio filters—Auto Pan, Bass and Treble, Chorus, Flanger, High and Low Pass filters, Parametric Equalization, Notch/Hum, Multitap delay, Noise gate, and more. Our favorite is the Compressor/Expander, which controls the dynamic range of the loudest and softest sounds in an audio clip. Most pros use these tools to "fatten up" a voice and make narration more understandable. *Premiere* has revamped sound resampling during import, supports 48kHz audio, and still has "rubber band" controls for volume.

Adobe has committed to open standards, which makes *Premiere* attractive to plug-ins developers for transitions, EDLs, accelerators, and machine controls. It does support multi-threading and MMX processors. *Premiere* also has tighter support for the DPS capture card and the commitment to support cards with realtime effects in the near future. That move will put *Premiere 5.0* firmly in competition with lesser systems costing many times more. At a list price of $895, *Premiere 5.0* is a bargain, with real potential to lower the admission price of high-end video post-production.

—Laurence Bartone

Old time Premiere users might not like how it handles transitions now, but that's OK because...



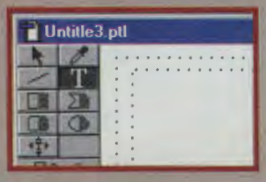
...if you click on the arrow key to the left of the timeline window, it'll bring you back to how they did things in the old days.

CREATING ROLLS AND CRAWLS ON TITLES

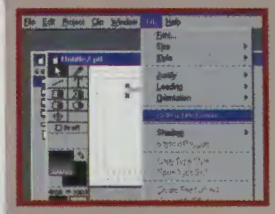
One of the coolest new features in *Premiere* is the ability to create Rolls and Crawls in your title sequence. Begin by going to the Titler.

- Before you begin titling, right-mouse-click to bring up text options. From this menu, you can set your text's attributes.

- After you've selected your font size and style, select the large [T] and begin typing. Use the [T] with the four arrows on it in the left-hand side of the titler to adjust your text on the page.



- From the drop-down Titles box, choose the Rolling Title option and set your preferences. You can set up all facets, including pre-roll, post-roll, ramp up and down, direction, and speed.



- Combine this with translucent drop shadows, textures, ramped colors, motion effects, text boxes, and shapes, and you've got a first-class title maker.

MAXIMUM PC VERDICT

Price $895 ($199 upgrade)
Company Adobe
Phone 800.492.3623
URL www.adobe.com

9

Pionex 826010

Selling out comes with a price

First-gen Celeron is found wanting.

Celery: It's rich in vitamin C but never seems to satisfy your hunger.

Celeron: It'll keep your wallet packed but won't quench your thirst for power.

But Intel's entry-level chip is designed to steamroll those pesky Socket 7 chip makers, not pack your pockets with power. Pionex's staid Model 826010 fits the bill for those looking for the basics, not gaming straight out of the box.

Cracking open the case, we were instantly impressed by the Celeron's nakedness. Intel cut production costs by leaving out the onboard L2 cache and plastic case of the Pentium II. It still snaps into a stock Slot 1, but with different support brackets.

What a difference cache makes. Performance was, as expected, ho-hum. While it motors past anything in the classic or MMX Pentium lines, the Celeron pulled bootMark scores far below Intel's slowest Pentium II with cache. A 266MHz Pentium II pulls in about 125 on the bootMark. The Celeron's 84.1 shows where performance goes when you don't have any cache in the system.

Pionex equips the 826010 with a Cirrus Logic–based AGP card. The videocard failed our OpenGL gaming benchmark and sputtered along with 13fps in the ForsakenMark at 800x600. Thankfully, Pionex threw 4MB of RAM that'll give you 24-bit color at 1024x768.

As shipped, the hard drive in the Pionex crawled past our HD Tach test with an average transfer rate of 5,983, but made up for the indiscretion by giving you double the capacity other manufacturers provide in this price range. Performance with 3D rendering and *Photoshop* functions also turned in an expected tepid performance. The generic 32x Max Lite-On CD-ROM turned in a surprising 19x rating, about average for "32x" drives.

We couldn't get the 826010 to complete SYSmark 98. On the older SYSmark 32 bench, the machine turned in a barely acceptable 180. A Sony PCV-150 MMX 233MHz Pentium scored 188 in SYSmark. What's up with that? Someone punked out here.

The 826010's main strengths and weaknesses lie in its upgrade paths. While many near-$1,000 computers shave costs by integrating sound and video onto the motherboard, Pionex used add-in cards for both. Unhappy with the addled Cirrus Logic card? Slap in an AGP StarFighter or the latest and greatest from nVidia or Matrox to boost performance. Want 3D positional sound? Throw in a Turtle Beach Montego or Diamond Monster Sound. But the 826010 runs into a wall with its MicroATX formfactor and limited memory expansion and PCI slots. Put the 826010 against a 300MHz AMD K6-2 and you'll go home red-faced and ashamed. Although it's a jewel to overclock, this Celeron is found wanting in performance at its native clock speed. But remember: always spring a few hundred bucks and slap in up to a 333MHz Pentium II.

The 826010 isn't a gaming machine out of the box, nor is it a bruiser for crunching desktop applications. It's a good entry-level machine for hobbyists who want to get in on the ground floor with room to grow.

—Gordon Ung

UNDER THE HOOD

THE BRAINS	
CPU	Intel Celeron 266MHz Processor
L2 Cache	None
RAM	32MB SDRAM
Motherboard	Pionex Biostar on EX chipset
Drive Bays	One AGP, three PCI, and two ISA (one PCI shared with ISA)
I/O Ports	Two USB, two serial, one parallel, one gameport
DISPLAY	
Videocard	Cirrus Logic AGP with 4MB
Monitor	Pionex 15-inch
Res/Refresh	1024x768@60Hz
STORAGE	
I/O	EIDE on motherboard
Hard Drive	Quantum Bigfoot 6.4GB
CD/DVD	Lite-On LTW-301 32x max drive
Removable	1.44MB Floppy
Fax/Modem	K56flex Internal WinModem
SOUND	
Sound	ESS-1869-based ISA soundcard
Speakers	MLI 691H 7-watt speakers
THE BUNDLE	
Corel WordPerfect Suite 8 | Microsoft Money | Compton's Interactive Encyclopedia | Compton's Reference Collection	

BOOT 1:08 DOWN 0:04

PLUSES

- Nothing soldered onto motherboard, making upgrades painless
- Light on the wallet compared to a top-of-the-line Pentium II

MINUSES

- Speakers so cheesy, we nicknamed 'em Cheez Whiz
- MicroATX limits expansion
- Bargain-basement performance

REAL WORLD BENCHMARKING

CPU/MOTHERBOARD bootMark		84.1
WINDOWS APPS SYSmark 32		180
HARD DRIVE HD Tach	MB/sec	5.8
CD-ROM CD Tach98	K/sec	19.4
3D RENDERING Newtek Inspire3D	sec	1077
DESKTOP PUBLISHING Adobe Photoshop 5.0	sec	295
DIRECT3D ForsakenMark	fps	13.0
OPENGL Quake2 v3.15	fps	failed to run

MAXIMUM PC VERDICT

Price $1,099
Company Pionex
Phone 800.619.1059
URL www.pionex.com

5

EXPANSION NOTES

What do you want to buy today? The Pionex gives you good upgrade options for a near-$1,000 machine. Upgrade video, sound, and CPU with impudence.

EXPANSION MAP

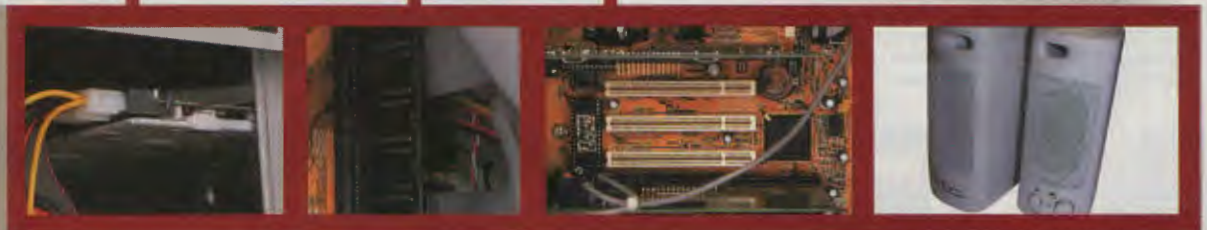
AGP	2D/3D Video Card
PCI	Free
PCI	Free
PCI/ISA	ISA Sound card
ISA	56K Modem

IRQS

00	System timer	08	System clock
01	Keyboard	09	Free
02	Interrupt controller	10	USB
03	Modem	11	2D Videocard
04	COM1 port	12	PS2 mouse
05	Soundcard	13	Num data proc
06	Floppy port	14	IDE controller
07	LPT1 printer port	15	IDE controller

DMAS

01	Soundcard	05	Open
02	Floppy controller	06	Modem
03	Soundcard	07	Modem
04	DMA controller		



Big foot, big footprint While the 6.4GB is nice for a near-$1,000 machine, the loss of a full 5.25-inch bay isn't appreciated.

Make that a 128MB DIMM, Sir You can add one, just one, more memory module and you're out, man.

PCI dilemma Choose your upgrades carefully. With one shared ISA/PCI slot taken, you only have two PCI slots left to expand.

Did we mention the speakers? We didn't know if these speakers were real or the mock-ups you see on desks at an Office Depot. They instantly made us pine for LabTecs.

Matrox Millennium G200

From zero to hero

MAXIMUM PC KICK ASS! product

Kung fu chopping its way back from the 3D ghetto is Matrox, with its MGA-G200–powered line of 2D/3D videocards. And the Millennium G200 is leading the charge back to the desktop with a superior combination of extra-tasty-crispy 2D performance and terrific 3D that sets a new level of visual excellence.

Long known for eyeball-seducing 2D, but piss-poor 3D, Matrox has finally come to its senses. Powering this Millennium G200 is Matrox's proprietary dual 64-bit parallel-processing architecture (known as the 128-bit DualBus), which is built specifically for high-end 2D desktop work, as well as megapixel pushing.

The Millennium G200 (armed with the MGA-G200 chip), makes up for Matrox's past follies.

PLUSES
- Excellent 2D and 3D performance
- 32-bit color renderer
- Fast 250MHz RAMDAC
- 16MB of fast SGRAM
- AGP 2x/with sidebands
- Excellent 2D control applets
- Super-high refresh rates

MINUSES
- Still not as fast as dual Voodoo²
- No multitexturing in a single pass

While most boards (including Voodoo², i740, Riva 128, and Vérité V2x00) are stuck at 16-bit rendering depth, the MGA-G200 internally renders at 32 bits (a process Matrox dubs Vibrant Color Quality), then dithers down to the application's needs. Since most games render out to 64,000 colors, don't expect a leap in visual quality. But as games push higher-res textures with greater color, you'll need higher color depths and a higher color-depth Z-buffer. Without one, you'll see banding patterns. And with the appropriate amount of local memory (8MB minimum, upgradable to 16MB), double- and triple-buffering can pump up performance.

Straddling the Millennium G200's AGP 2x PCB is 16MB of SGRAM (8MB on board and 8MB via memory module), which allows this board to reach up to 1900x1200 resolution. And with help from a 250MHz RAMDAC, refresh rates as high as 200Hz can be obtained at lower resolutions. 2D visual quality is crisp and clean, with no hint of fuzziness—this is the way all 2D should look.

Does the Millennium G200 banish the 3D stigma its predecessors bore? Hell yeah! Texture-mapped polys, regardless of game, are rich in color, with excellent saturation and hues. Alpha blends and colored-lighting effects appear beautiful, although a visible mip-mapping demarcation is readily apparent.

On the performance tip, the Millennium G200 proved faster than a lone Voodoo² card, pumping a cool 64.61fps at 800x600 *Forsaken*. *Battlezone* performance is also solid. The only game that bogged down the MGA-G200 was *Descent: Freespace*. At press time, Matrox's OpenGL Installable Client Driver wasn't ready, but Matrox did have a D3D/OpenGL wrapper. Under *Quake II*, scores at 800x600 fell short of matching a single Voodoo² board, posting 27.0fps. Expect performance to get a shot in the arm when the real ICD is released this summer. While the card will be able to work single-cycle trilinear mip-mapping, multitexturing will happen in multiple passes, thus causing a slight performance hit for games based on *QuakeGL* technology.

Matrox has at last shaken its "mystakes" with an intense product that should be at the top of anyone's videocard list.

—*Andrew Sanchez*

BENCHMARK MACHINE: Micron Millennia Xru with 300MHz Pentium II processor. 64MB of SDRAM, Intel Atlanta 440LX ATX motherboard, Windows 98 final release with DirectX 6 beta. Quake II benchmark results using demo2.dm2 and Matrox's GL-to-D3D wrapper.

THE SPECS

MAX 24-BIT RES/REFRESH RATE	1920x1080/76Hz (32-bit)
MAX 16-BIT RES/REFRESH RATE	1920x1200/76Hz
VESA 2.0 COMPLIANT?	YES
AGP?/LEVEL	YES/2x
AGP DIRECT MEMORY EXECUTION?	YES
BUNDLE	Win95 and NT 4.0 drivers | Micrografx's Picture Publisher 8 | Simply 3D 3 | Netscape Communicator | PointCast | Imagination | 3Deep | Game Bundle TBA

MAXIMUM PC VERDICT

Price $228 (as tested with 16MB SGRAM; $149 for 8MB version)
Company Matrox
Phone 800.361.1408
URL www.matrox.com

9

3D Studio Max 2.5

And the third-party plug-ins that love it

Release 2.5 of Kinetix's *3D Studio Max* takes a proven performer deeper into SGI and Unix territory. *Max* has the muscle to create amazing 3D content, but is definitely *not* for the faint of heart, or the faint of wallet.

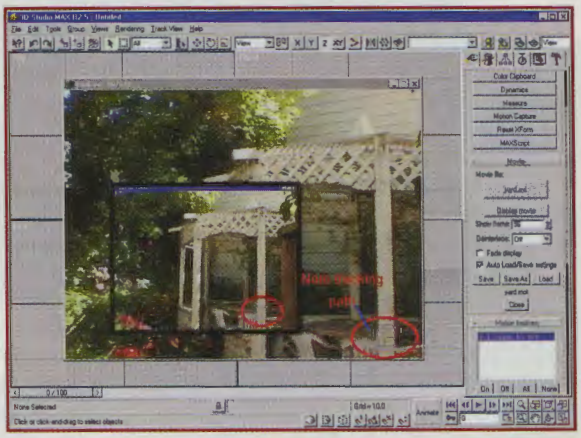
Discreet Logic, brings unique enhancements to the desktop through two plug-ins: Paint, an automated rotoscoping tool, and Effect, for 3D paint effects.

Digimation comes through with Bones Pro, a suite of four utilities that take the pain of boning, and Shag: Fur, the digital equivalent of Rogaine.

—Rick Stevens

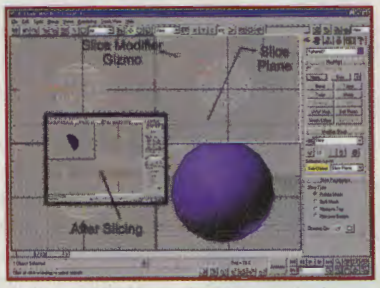
3D Studio Max 2.5

Basic mesh modeling, shading, lighting, and animation have been around for years, and *Max* is a pro at all of them. This release focuses on practical improvements in several modeling disciplines including NURBS lofting, polygon reduction, and multi-sub object material assignment. The operative word: "productivity."



NURBS modeling animation now allows lofting just like its geometric cousin. Game developers concerned with minimizing polygon counts now have new subobjects to automate the reshaping of trimmed surfaces. Merely positioning the plane of a slice modifier gizmo (an imaginary form that defines the area to be changed) causes the object to be refined or split into new vertices, faces, or edges according to a user-defined choice. More important is that this feature can be animated. UV lofts, and one and two rail sweeps can now be defined at the subobject level. The parent objects of dependent subobjects can even be replaced at the user's discretion. Formerly, noneditable meshes couldn't be automatically cut and sliced. Now they can. Finally, multiple material modeling and assignment now uses simple drag-and-drop techniques. A task that used to be tedious and time-consuming is no longer so. All these improvements with 6-bit names boil down to time saved. But Kinetix didn't stop there.

The ability to track an area over time typifies 3D Studio Max's strengths.



A slicing modifier applied to a mesh object.

Melding live footage with animation is another daunting task. *Max 2.5* introduces yet another time-saving feature to tame this monster: the Camera Tracker Utility. Simply put, you define movement coordinates, much like key frames, and a range of pixels to track. These data move the "camera" just like the live camera. Here, a new development propels an already meaty offering into the realm of the sublime.

Max can now directly import VRML and VRBL virtual-reality formats and export a scene or animation to version 2.0 file format. The web is now even more accessible to game developers.

Maxscript has been updated to reflect new capabilities in release 2.5, and the Lens Effects topics have been revised and updated with new tutorials. Have a stable of 2.0 plug-ins? Don't fret. Vendors of more than 100 plug-ins have pledged updated versions, most at no additional charge.

Finding something not to like about *3D Studio Max 2.5* is difficult. If you're a serious 3D animator and want to push the envelope to save time and money, *Max 2.5* is a must-have.

THE SPECS

WHAT YOU NEED

150MHz processor
Windows 95 or NT 4.0
64MB RAM
300MB hard disk space

PLUSES

- Integrated user interface
- Twelve levels of mapping in the Materials Editor
- Open modeling architecture
- Support for all industry-standard file formats

MINUSES

- Steep learning curve
- Over-abundance of jargon
- Sketchy documentation
- Steep hardware requirements

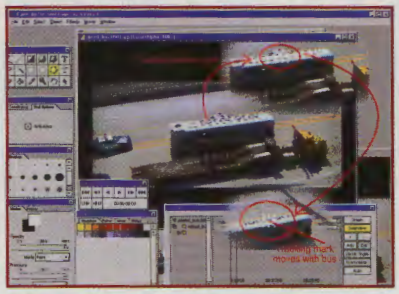
MAXIMUM PC VERDICT

Price $3,495/Upgrade from Max 2.0 $95
Company Kinetix
Phone 888.890.4456
URL www.ktx.com

10

Paint Plug-in

Paint is a vector-based rotoscoping plug-in. Picture a tour bus with a number on top moving rapidly down a freeway. The bus moves beneath a freeway sign, which casts a shadow from front to back. To eliminate the number the old way, you exported a frame sequence, then imported it into a bitmap-editing program, whiting out the number on each frame separately. If the effect is undesirable, you would undo, then redo it, frame by tedious frame. Paint changes that entirely. The new way is to create one mask on the first frame and the last frame of the sequence, then define the pixels to be tracked. In Paint, the mask tracks automatically throughout the clip. But the tracking area is still white under the shadow cast by the freeway sign. No problem. Paint a darkened area where the shadow should be in seven frames. Each of our "bitmap" marks is really a vector graphic that it can be rotated, scaled, or redrawn without undoing. What a timesaver. Paint comes with a panoply of shapes, including filled and outline rectangles, ellipses, polygons, lines (orthogonal and freehand), and effects such as noise, distort, sharpen, and stylize.



Paint-masking effect automatically moves with the bus.

Anyone familiar with Adobe *Photoshop 4.0* or above will immediately feel at home.

MAXIMUM PC VERDICT

Price $1,995
Company Discreet Logic
Phone 514.393.1616
URL www.discreet.com

7

Effect Plug-in

Effect uses the depth information written into *3D Studio Max*'s file to apply special effects to existing rendered animation footage. If a fickle client wants another light added or colors punched up at the last minute, there's no need for panic. Effect can take the full range of filters (sharpen, color correction, distort, stylize, etc.) and rendering effects such as shadows, shading, and reflections, and apply them to an existing animation *without* the need to re-render.

Moving a light source changes lighting in a rendered animation.

A demo clip of two dancers prancing around a pillar and into a lighted chamber beyond offers a glimpse into Effect's potential. Add a light and move it in 3D space over time and all shadows, shading, and lighting effects follow it as if it were part of the original file. Move one dancer to the left, and Effect correctly places the pillar in the foreground when he moves behind it. Add lights or lighting effects to the chamber, and all reflections on the marble floor are automatically updated. Imagine the savings in time, frustration, and money.

Both Paint and Effect are aimed directly at Hollywood special-effects houses. To sweeten the pot, *Max 2.5* adds importing support for the Kodak Cineon film recorder format, SGI's RGB format (at 16 bits per channel), and Apple's *QuickTime 3.0* industry-standard digital-video format.

MAXIMUM PC VERDICT

Price $1,995
Company Discreet Logic
Phone 514.393.1616
URL www.discreet.com

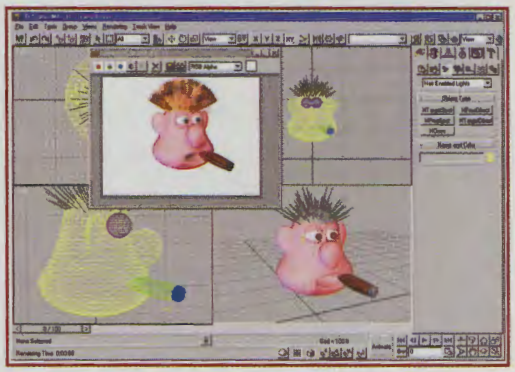
9

Shag: Fur Plug-in

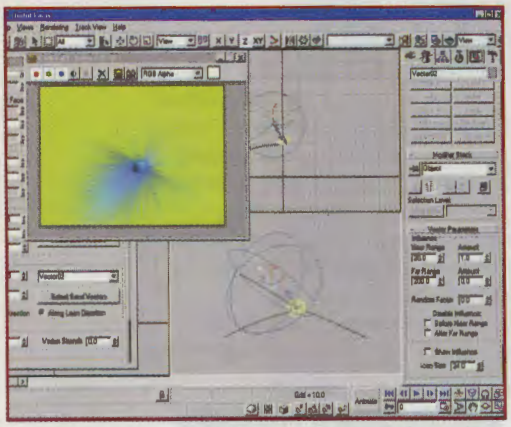
Things can get a little hairy around the typical animation and special-effects studio and Shag: Fur, a plug-in for *3D Studio Max*, can definitely smooth things out. This is a versatile and extremely easy-to-use subroutine that adds its specialized rendering engine to the Environment dialog in *Max*.

There are some gotchas, though. The rendering must be from a camera viewport in order to work at all. At least one "hair enabled light" must be included in the scene, and in order to render shadows properly, its shadow casting option must be on. All sample files had "obsolete data format" errors, and several were missing backgrounds. Once these minor matters were resolved, the tutorials were clear and informative. Finally, the authorization procedure is truly cloak-and-dagger. A local routine within *Max* queries the program for the *Max* dongle number, then Digimation takes that number and gives you a weird 17-character code to enter into the dialog to activate the plug-in.

112 ▶



Fur applied to a cartoon character's head. Notice the multicolored rendering



Rendering of a seaworm Notice the vectors in wireframe views.

▶ 111

Fur can be applied to any object or multi-subobject selection desired. The easiest way is to assign unique sub-material numbers to the desired faces and tell Shag: Fur which ones to plug. Parameters such as the length of strands, thickness, and density per face are selectable and random values applied to simulate reality. Color can be specified as specific base and tip color or taken from a bitmap applied to the object in the Material Editor. Natural effects such as leaning and bending are simulated using special vectors added to the Helpers toolkit by Shag: Fur. Total control over angle, randomness, and range is provided. Several vectors can be applied to the same object with differing weights. All these features can be animated, too.

Any animator creating furry critters should have Shag: Fur in their toolbox.

MAXIMUM PC VERDICT

Price $295
Company Digimation
Phone 800.854.4498
URL www.digimation.com

6

Bones Pro Max

Tedious boning of complex mesh objects has never been a fun task. Bones Pro Max takes some of the angst out of this chore.

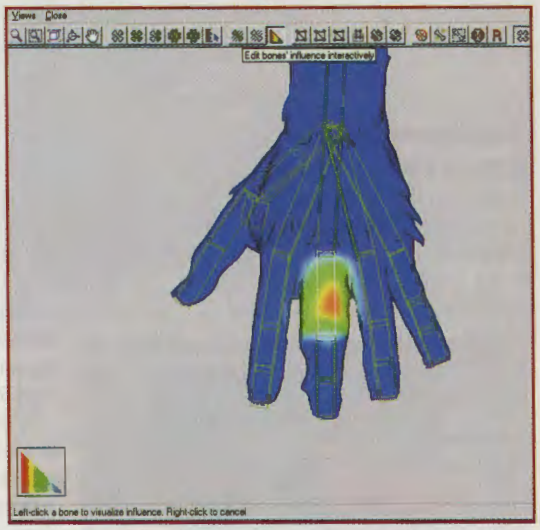
Bones Pro's Max module will modify parameters, allow tweaking of a bone's influence on the mesh along its length in 1% increments. The strength of influence parameter adjusts the tenacity of the attraction. The Influence Editor Window paints a color-coded pictograph of each bone's sphere of influence. Visualizing where the mesh went astray is a snap. All parameters can be reset and the new settings viewed in this window. Editing right down to the vertex is supported. Very powerful.

Skeleton takes a select set of bones generated by Max's Bones System, then builds boxes around them. Building and positioning boxes for hundreds of bones would take forever, but one mouse click does it all with Skeleton.

Blend smoothes out sharp seams on Boolean objects. Picture a "tree" with a cylindrical trunk and angled cylinders joined to create "branches." Blend takes these sharp, unnatural joints and smoothes them into a curve, just like a tree's branch joint.

Snapshot Plus is great for freezing a space warp at a point in time. Convenient, but not a necessity.

Any serious character animator can save valuable time by using Bones Pro.



The Influence Editor Window showing area of influence of bone (red is highest).

MAXIMUM PC VERDICT

Price $495
Company Digimation
Phone 800.854.4498
URL www.digimation.com

8

QUICKLY BUILD A SPACESHIP

▶ Using the Create/Geometry option, create a sphere.

▶ Scale down the Y dimension in the top viewport, then the X dimension in the front viewport. The result is a flattened, elongated disk.

▶ With the disk object selected, clone a copy of the disk object, move it slightly to the left of the original, rotate it 90 degrees about the Z axis.

▶ Move the clone to the right and align it with the back of the original in the top viewport.

▶ Scale the clone down in the Y dimension first in the top viewport, then in the left viewport.

Move it into place toward the back of the original disk.

▶ In Create/Objects, select Compound object, then Boolean 2. With Union specified, select the disk, then Pick Operand B, then the clone. Max joins both shapes into one.

▶ Place the lights: one spot front and to the right of the star, one in front and shining on the spaceship from below.

▶ Assign a slightly dull silver material to the spaceship.

▶ Finally, use a starfield bitmap as an environmental map for the background, and render.

Want to see more?

Visit us at maximumpcmag.com

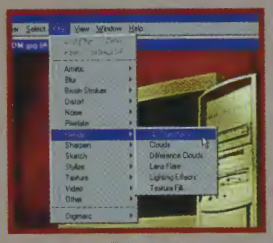
If you can't get enough of this stuff, you've got to visit our web site: **maximumpcmag.com**. It has even more of the good stuff you love. This free, online resource is the perfect companion to **Maximum PC** magazine. It's the fastest way to access information about the companies and products you read about in this magazine.

Updated daily, **maximumpcmag.com** contains the best our editors have to offer. Just like the magazine, our web site is truthful, hard-hitting, and speaks directly to your PC passion. Give it a try and visit **maximumpcmag.com** today. There's only one **Maximum PC** magazine, and there's only one web site that delivers the goods. It's the real thing, baby.

MAXIMUM PC

HEY! YOU GOT 3D IN MY 2D!

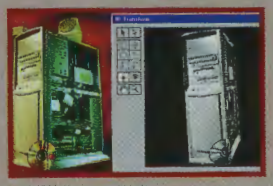
A nifty feature of *Photoshop* 5.0 is the new 3D Transform command that maps your 2D image selection onto a 3D frame, similar to the way 3D polygon games such as *Quake* map texture maps onto their polygon worlds. The process is simple and surprisingly effective.



▶ First, select the 3D Transform command from the Render section of the Filter menu.

▶ Then, choose which best suits your subject (in general, the effect works best with the cube), and drag out a rough cube.

▶ Now, use the open arrow to line up the corners of the 3D overlay onto the vertices of the 2D shape you want to map. This can be tricky since only the front points on the bottom and the center front point on top are adjustable, so you you'll probably need to adjust your field of view in the slider to the right.



▶ Finally, go to the camera pan and trackball tools to rotate your newly rendered object in 3D space. Options in the tools allow you to block out the background and set the image res and degree of anti-aliasing.

Photoshop 5.0

The Godzilla of graphics apps is back

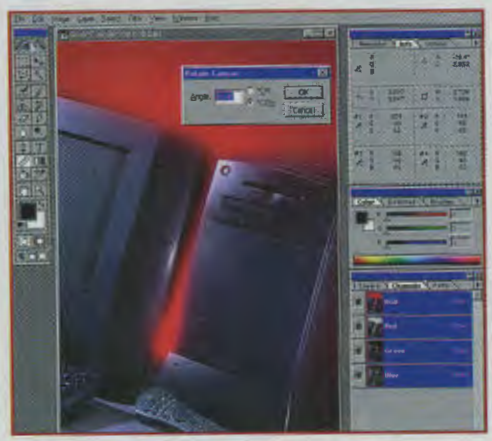
MAXIMUM PC KICK ASS! product

Anyone disappointed by the babysteps that *Photoshop* took between versions 3 and 4 will be relieved to discover that the leap to version 5 is quantum, replete with new features and significant improvements to existing ones. While Adobe stills seems reluctant to migrate its cash cow into the online era, this latest iteration still represents a major stride by the dominant digital graphics app.

The Layers palette that anchored the last revision of *Photoshop* has been injected with some serious steroids this time out. New canned effects include a one-stop layer effects that add 3D-style bevels, embossing, inner- and outer-glows, and the oh-so-popular soft drop shadow that streamlines a designer's workflow exponentially. And powerful user-controlled options allow all shadows and bevels in a document to share the same light source, for far more natural effects with far less labor.

Other labor-saving devices include a slew of powerful new tools, such as "magnetic" versions of the traditional pen and lasso selection tools. These crafty gadgets make selecting contrasting areas a snap, as your crude circumvention automatically snaps to the object's edges as you draw, with user-designated precision. The pen version of the tool creates an editable bezier path similar to the product of another of *Photoshop 5.0*'s new tools, the freeform pen. Vector-based Illustration programs have long featured a simple way to draw directly with the mouse, avoiding all the point setting and handle tweaking that lent those programs their step learning curve. Now, the new version of *Photoshop* has the same convenience.

Another feature designers expect of their illustration software is complete control over all the typography. Unfortunately, *Photoshop* users could never match the complete character-level control that their vector-based counterparts enjoyed. And the inability to go back and edit copy content or style was the bane of designers working in past versions of the program.



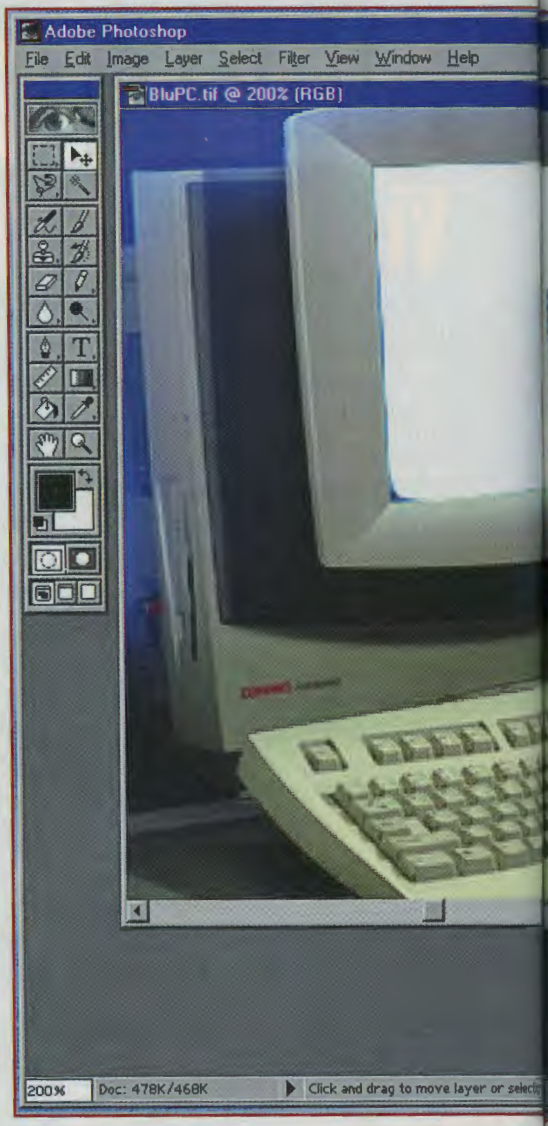
The enhanced info box now links into the new measure tool to make your image rotations not so arbitrary. The measured angle is even automatically transposed into the Rotate Canvas dialogue for level horizons in a snap.

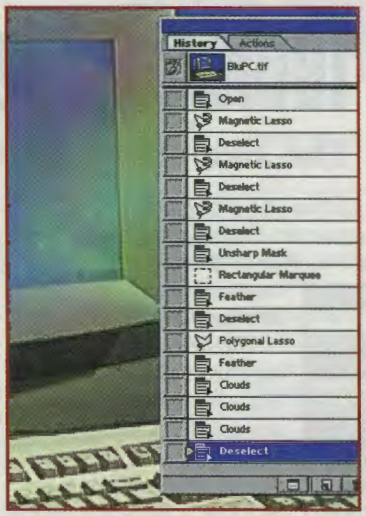
Using this new version of Photoshop's magnetic lasso tool, selecting the screen from this tres Jetsonian Compaq system is so easy, even Elroy could do it.

Until now.

Version 5.0 adds both of these features, along with a live preview. And believe us, the upgrade will pay for itself the first time you have to go back and change one word in a picture and watch all the subsequent effects applied to the type reapplied to the new edit.

Another seemingly simple feature long overdue for *Photoshop* owners is multiple undo. Every





Photoshop 5.0's powerful new History palette delivers the multiple undo capabilities that designers have demanded since the program's inception.

other graphics app under the sun has had this ability, except *Photoshop*. Now the premiere image editor has multiple levels of undo... with a vengeance. A new History palette tracks your every command, down to details such as object dragging, and a single click in the tracking list takes you back to any given step. Specific steps can even be selected and applied to the image, anywhere in its history. And snapshots can be taken of a project in any stage of development to allow branching variations for more creative possibilities.

While casual home digital photo buffs or web designers may not need the new depth added to *Photoshop 5.0*, hardcore digital pre-press pros will love the incredible new color controls for press, including support for phat 48- and 64-bit color palettes, dot gain curves, and spot-color channels for adding those fancy fifth colors, metallics, varnishes, and other specialty effects to print jobs.

And when you're not sending the image to print, or to the monitor, special optimized color spaces are now available that leverage the gamut of broadcast standards such as NTSC, PAL, and HDTV.

Some early criticism has arisen concerning Adobe's choice for a default RGB color space. The gamut is optimized for monitor calibration and limits the possible color range. Ultimately, the success or failure of that choice depends on which is a higher priority for demanding designers: broad color gamut or more accurate monitor representation.

Despite this, ultimately *Photoshop 5.0's* refusal to enter the online age (all those features were left out and sell under the name *ImageReady*) is the only thing keeping this Godzilla of graphics from getting a perfect score.

—Brad Dosland

PLUSES
- powerful multiple undo palette
- magnetic selection tools
- editable type
- powerful digital prepress tools
- cool Layers palette effects

MINUSES
- web tools sold separately as Image Ready should be included for the price
- Dubious choice of RGB color space

THE SPECS

REQUIREMENTS
- Pentium
- Win95/98/NT
- 64MB RAM
- 80MB Hard Drive
- CD-ROM Drive

MAXIMUM PC VERDICT

Price $650 ($200 Upgrade)
Company Adobe
Phone 800.492.3623
URL www.adobe.com

9

NOT IMAGEREADY FOR PRIMETIME

The most regrettable thing about the latest update to the proud *Photoshop* legacy is the exclusion of long-anticipated tools for web designers. Most other major graphics apps have already adopted features such as animated GIF support, image map creation, and web image previewing. Unfortunately Adobe has dragged their programming feet and not included these modern features in version 5.0. They have, coincidentally, included just this in a stand-alone package called *ImageReady*. For an additional $199, web designers get to swap between the two programs in order to do the same thing other graphics apps do under one roof. Adobe needs to include these features in the next major revision of *Photoshop*. Right... and they'll include *Dimensons* in the next *Illustrator*.

Iomega Jaz 2

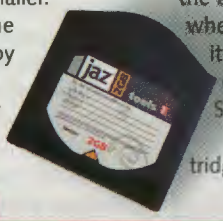
The rebirth of cool

The Jaz 2GB external drive utilizes a fast SCSI-2 interface and is easily portable, if a SCSI card is installed on the target machine.

Iomega has thrown down the gauntlet, doubling its disc size to 2GB. And it's done so while including backward compatibility with its older 1GB cartridges.

The new 2GB cartridge uses two 3.5-inch platters and is housed in the same size case as its 1GB cousin. The difference is that the areal head density of a Jaz 2GB disk is twice that of the 1GB, meaning that more data is crammed into a tighter space. When 2GB cartridges are used, the drive shines. Problem is, it takes longer to erase and record data to older 1GB disks because the Jaz 2GB heads are smaller.

And it shows in the benchmarks. The copy test on an older 1GB disc was dramatically slower on the 2GB drive; it took almost twice as long as copying a 1GB disc on a 1GB Jaz drive. The read speed of older 1GB media is on par with older 1GB drives, though. 2GB media delivers excellent data throughput times, with Jaz being the clear winner here when compared with its lower-priced competitor, SyQuest's SparQ.



The Jaz drive and 2GB cartridges both offer portability, are based on high-speed SCSI technology, and are much sturdier than the SparQ. The Jaz drive's biggest downside is its price, even with 2GB cartridges costing only $25 more than 1GB cartridges. Jaz is ubiquitous due to its large installed base, which seems the only reason it outsells SyQuest's SyJet 1.5GB, which outperforms it and is cheaper.

But Jaz technology sometimes fails. Discs often degrade over time, and drives can become erratic, requiring replacement. We've found that Iomega is good about replacing both drives and media, though.

It takes more than ubiquity to be the best. Lower prices and faster write speeds would make Jaz the undisputed champion. If only.

—Sean Cleveland

THE SPECS

REQUIREMENTS
- 486 or higher
- SCSI adapter

RECOMMENDED
- Pentium or higher
- Ultra SCSI adapter

BUNDLE
- SCSI-2 50-pin to 50-pin cable | 1 Jaz 2GB disc | SCSI 50-pin to 25-pin converter | Extra software

PLUSES
- Full backward compatibility
- Portable high-speed SCSI interface
- Automatic SCSI termination
- Excellent software bundle
- Excellent read performance with 2GB media

MINUSES
- Very expensive
- Performance degradation with older media
- Disks often fail, requiring replacement
- Jaz jet SCSI card not included
- Lackluster write performance

DARE TO COMPARE

	IOMEGA			SYQUEST	
	JAZ 1GB	JAZ 2GB		SPARQ	SYJET
Capacity Tested	1GB	1GB	2GB	1GB	1.5GB
Interface	SCSI	SCSI	SCSI	ATAPI	SCSI
Drive Price	$280	$500	$500	$200	$300
Cartridge Price	$100	$125	$125	$40	$80
HD TACH BENCHMARKS*					
Average Read Speed (MB/sec)	5.1	5.0	6.25	5.5	4.9
Average Write Speed (MB/sec)	1.1	0.4	1.2	2.3	1.9
Random Access Time (ms)	19.2	19.7	19.1	20.4	23.2
Read Burst Speed (MB/sec)	7.3	12.1	12.2	11.8	6.1
CPU Utilization	1.1%	0.5%	1.2%	1.0%	1.6%
REALTIME COPY BENCHMARK**					
Time to fill disc (min)	16:51	39:31	22:36	7:31	13:14
ADAPTEC THREADMARK***					
Average Throughput MB/sec	2.17	2.07	2.57	2.13	1.48
CPU Utilization	7.53%	7.23%	8.85%	6.85%	5.96%

*Performs sequential reads from all areas of the platter. **Tests the time it takes to copy Maximum CD disc #1 to the drive. ***Measures multithreaded disk performance under high I/O activity. TEST SYSTEM: Quantex QP6/400 SM-4x 400MHz Pentium II with 64MB and Jaz jet SCSI PCI card ($125)

MAXIMUM PC VERDICT

Price $499 (additional cartridges $125, 3/$300)
Company Iomega
Phone 800.697.8833
URL www.iomega.com

7

SYQUEST INTERNAL 1GB SPARQ

The internal SparQ uses an IDE ATAPI interface, sacrificing portability for performance.

The SyQuest SparQ comes in two flavors: a portable parallel port version and an internal ATAPI version. Both use a single 3.5-inch platter housed in flimsy plastic.

After much prodding, we succumbed and benchmarked the internal version. The tape mechanism is on the shoddy side, and one of our cartridges repeatedly got stuck, requiring intervention with a screwdriver. Hence, its low price.

But unlike Jaz media, we've never witnessed a SparQ cartridge fail. In fact, throughput, both read and written, was admirable and reached record times. The included utilities did not properly recognize the drive and were basically worthless.

Don't make one of these a secondary device to an Ultra DMA hard drive or you'll experience throughput degradation.

The biggest drawback, of course, is the drive's nonportability. If SyQuest manufactured SCSI-based SparQ drives at the same price, they'd truly rival the Jaz regime.

—Sean Cleveland

MAXIMUM PC VERDICT

Price $200 (additional cartridges $40, 3/$100)
Company SyQuest
Phone 510.226.4000
URL www.syquest.com

8

ADVERTISEMENT

How to make your car invisible to radar and laser

Rocky Mountain Radar introduces a device guaranteed to make your car electronically "invisible" to speed traps—if you get a ticket while using the product, the manufacturer will pay your fine!

by Phil Jones

If your heart doesn't skip a beat when you drive past a speed trap—even if you aren't speeding—don't bother reading this. I can't tell you how many times that has happened to me. Driving down the interstate with my cruise control set at eight miles over the limit, I catch a glimpse of a police car parked on the side of the road. My heart skips a beat and for some reason I look at my speedometer. After I have passed the trap, my eyes stay glued to my rear view mirror, praying the police officer will pass me up for a "bigger fish."

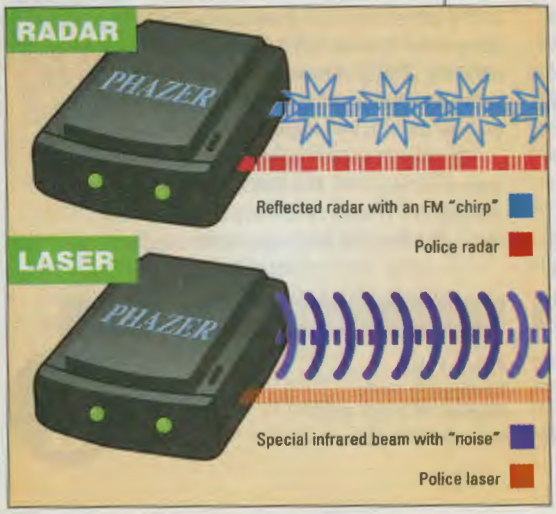
■ ***The Phazer will "jam" both radar and laser guns, preventing police from measuring your speed.***

It seems that as speed-detection technology has gotten more and more advanced, speeding tickets have become virtually unavoidable. And although devices exist that enable motorists to detect these speed traps, they are outlawed in many states... including mine.

The solution. Today, Rocky Mountain Radar offers drivers like me a perfect solution—the Phazer. Combining a passive radar scrambler with an active laser scrambler, the Phazer makes your automobile electronically "invisible" to police speed-detecting equipment.

The radar component works by mixing an X, K or Ka radar signal with an FM "chirp" and bouncing it back at the squad car by way of a waveguide antenna, effectively confusing the computer inside the radar gun. The laser component transmits an infrared beam that has the same effect on laser Lidar units.

Perfectly legal. Some radar devices have been outlawed because they *transmit* scrambling radar beams back to the waiting law enforcement vehicle. The Phazer, however, *reflects* a portion of the signal plus an added FM signal back to the police car. This, in effect, gives the waiting radar unit an electronic "lobotomy." Best of all, unless you are a resident of Minnesota, Oklahoma or Washington, D.C., using the Phazer is completely within your legal rights.



HOW TO MAKE YOUR CAR DISAPPEAR

Radar and laser scramblers are devices that foil speed traps by making vehicles electronically "invisible" to police radar. Radar scramblers mix a portion of the radar signal with background clutter and reflect it back to the squad car. This technique, pioneered by Rocky Mountain Radar, creates an unreadable signal that confuses the computer inside the radar gun.

The laser scrambler in the Phazer works in a similar manner. It transmits a special infrared beam with information designed to scramble the laser signal. The result? Readouts on police radar and laser guns remain blank. As far as the police officer is concerned, your vehicle is not even on the road.

■ ***The Phazer makes your car invisible to police radar and lasers or the manufacturer will pay your speeding ticket!***

How it scrambles radar. Police radar takes five to 10 measurements of a vehicle's speed in about one second. The Phazer sends one signal that tells the radar the car is going 15 m.p.h. and another signal that the car is going 312 m.p.h. Because police radar can't verify the speed, it displays no speed at all.

Works with laser, too! The Phazer also protects your vehicle from Lidar guns that use the change in distance over time to detect a vehicle's speed. The Phazer uses light-emitting diodes (LEDs) to fire invisible infrared pulses through the windshield. Laser guns interpret those pulses as a false indication of the car's distance, blocking measurement of your speed.

Range up to three miles. The Phazer begins to scramble both radar and laser signals as far as three miles away from the speed trap. Its range of effectiveness extends to almost 100 feet away from the police car, at which point you should be able to make visual contact and reduce your speed accordingly.

Encourage responsible driving. While the Phazer *is* designed to help you (and me) avoid speed traps, it *is not* intended to condone excessive speeding. For that reason, within the first year, the manufacturer will pay tickets where the speed limit was not exceeded by more than 30%, or 15 miles per hour, whichever is less.

Double protection from speed traps. If the Phazer sounds good, but you prefer to be *notified* when you are in range of a police radar, the Phantom is for you. The Phantom combines the Phazer (including the Ticket Rebate Program) with a radar detector. It's legal in every state except Minnesota, Oklahoma, Virginia and Washington, D.C. Ask your representative for more details!

Risk-free. Speed traps don't make my heart skip a beat anymore. The Phazer and Phantom are both backed by our risk-free trial and three-year manufacturer's warranty. Try them, and if you're not satisfied, return your purchase within 90 days for a "No Questions Asked" refund.

The Phazer:
Three credit-card payments of $66.50 $14 S&H

The Phantom:
Three credit-card payments of $116.50 $18 S&H

Please mention promotional code **2546-13831.**

For fastest service, call toll-free 24 hours a day

800-399-7863

comtrad industries
2820 Waterford Lake Dr., Suite 102
Midlothian, Virginia 23113

Hyper-Speed CD-ROM Drives

The next generation

The current crop of high-speed CD-ROM drives aren't plagued by the problems of the past. Recent technological developments have mitigated the chief bugaboo—poorly constructed spindle motors that vibrated when improperly balanced discs were spun at high speeds, forcing the drive to reduce the speed to compensate. These new drives bring with them not only improved technology, but also some downright brilliant approaches to existing limitations. If anything, they illustrate other deficiencies that afflict new hyper-speed CD-ROM drives, such as the effect of slow random access times on throughput, and the benefit of high interface burst speeds. We threw Plextor's UltraPleX, the reigning champion, up against three new offerings and came away with some interesting results.

—Sean Cleveland

Kenwood TrueX 40x

PLUSES
- Flashable BIOS
- 45x speed across the whole disc
- The best real-world performance

MINUSES
- No multiread support
- Low random access time

AOpen CD-936E 36x

PLUSES
- Audio Play/Skip button
- Multiread support

MINUSES
- Atrocious real-world copy performance
- Sluggish full-stroke access times

Sony CDU711 32X

PLUSES
- Excellent random access time
- Great real-world copy performance
- Inexpensive
- Multiread support

MINUSES
- Performed overall as a 31x drive instead of 32x

Kenwood TrueX 40x

MAXIMUM PC KICK ASS! product

Kenwood has dropped the equivalent of a nuclear bomb on the CD-ROM industry with it's first offering, based on Zen Research's patented TrueX technology.

Zen's approach splits a laser beam that would normally read only a single track at a time into seven beams, spaced evenly to read seven tracks in parallel. Focus and tracking are accomplished by the center beam, while three beams on either side read the multiple tracks. The data is then processed through a custom, single-chip ASIC that accomplishes parallel processing and error correction via an integrated signal processor.

The head itself is split in two to reduce weight on the movable portion, in turn lowering access times.

THE SPECS

INTERNAL BUFFER
256KB
INTERFACE
Bus-mastering ATAPI (EIDE)
MEDIA SUPPORTED
CD-Digital Audio | CD Extra | CD TEXT | CD-ROM (Mode 1) | CD-ROM XA (Mode 2 Form 1 and Form 2) | CD-I* (Mode 2 Form 1 and Form 2) | CD-I Ready | CD-Bridge | Photo CD (single and multi-session) | Video CD | CD-Recordable (CD-R) and CD-ReWritable (CD-RW)

The real beauty of this technology is its CLV architecture, which ensures a constant data rate across a whole disc. By varying the speed the disc spins, Zen milks close to 7MB of data throughout the entire disc. This means the disc doesn't need to be full to realize the drive's full speed potential. And Zen doesn't need to worry about the spindle vibration problems other drives suffer because the discs spin at only 3,000RPM, roughly the speed of a 6x to 10x drive. It actually turns out that Zen labeled its drive conservatively.

We tested two drives that each delivered a drive rating above a whopping 45x. We streamed high-res video off this drive and never saw a dropped frame—imagine the possibilities.

The TrueX is for the hardcore user who demands a fat, consistent data-stream. Make no mistake, there is no faster CD-ROM drive available.

The two areas where it didn't dominate were burst speeds, due to its CLV nature, and random access times. These two areas define how quickly a piece of data can be found and how fast it can be pushed out sequentially, and it shows in the benchmarks. It took almost as long as the Sony drive to copy the Maximum CD. Zen will be releasing a SCSI version of the technology later this year that should address these shortcomings, as well as the drive's inability to read CD-RW media.

Of course, we're hoping this technology makes its way into the DVD market, and soon. Kenwood's TrueX is currently available only through HiVal, so get them while they last.

MAXIMUM PC VERDICT

Price $199
Company HiVal
Phone 714.953.3000
URL www.hival.com

9

DARE TO COMPARE

	SONY CDU711	AOPEN CD-936E	KENWOOD TRUEX	PLEXTOR ULTRAPLEX
Drive Speed	32x	36x	40x	32x
Interface	ATAPI	ATAPI	ATAPI	SCSI
Drive Architecture	CAV	CAV/CLV	CLV	CAV
Price	$99	$89	$199	$162
CD TACH BENCHMARKS*				
Drive Rating	20.5x	25.5x	45.7x	21.6x
Avg. 16K Sequential Read	3.4MB/sec	4.2MB/sec	6.8MB/sec	3.7MB/sec
Min. 16K Sequential Read	2.0MB/sec	2.5MB/sec	6.2MB/sec	2.2MB/sec
Max. 16K Sequential Read	4.5MB/sec	5.4MB/sec	6.9MB/sec	4.9MB/sec
Full Stroke Access Time	116ms	269ms	284ms	139ms
Random Access Time	67ms	98ms	92ms	83ms
4x CPU Utilization	1%	4%	1%	2%
8x CPU Utilization	2%	5%	3%	4%
12x CPU Utilization	4%	6%	4%	6%
Full Speed CPU Utilization	8%	10%	11%	13%
2K Interface Burst Speed	5.5MB/sec	2.6MB/sec	2.7MB/sec	3.6MB/sec
8K Interface Burst Speed	13.1MB/sec	11.0MB/sec	5.6MB/sec	8.2MB/sec
16K Interface Burst Speed	17.1MB/sec	15.4MB/sec	6.6MB/sec	10.6MB/sec
REDBOOK AUDIO EXTRACTION BENCHMARKS**				
Extraction Speed	18.9x	15.5x	17.5x	23.6x
Extraction Quality	Excellent	Excellent	Excellent	Excellent
REAL-WORLD COPY BENCHMARK***				
Time to copy contents	4:17min	22:03min	4:00min	4:19min

*Performs a full benchmark assault on CD-ROM drives. **Converts CD Audio to a WAV file. ***Time it takes to copy Maximum CD to hard drive. TEST SYSTEM: Quantex QP6/400 SM-4x 400MHz Pentium II with 64MB RAM.

THE SPECS

INTERNAL BUFFER
128KB

INTERFACE
Ultra DMA 33 ATAPI

MEDIA SUPPORTED
CD-Audio | CD-ROM (Mode 1 and 2) | CD-ROM/XA (Mode 2, Form 1 and Form 2) | CD-I | Photo-CD (Single and Multiple Sessions) | CD-EXTRA | I-TRAX CD | CD-RW | CD-WO and CD-R

AOpen CD-936E 36x

AOpen's newest contribution to the high-speed arena shows that incredible spin speeds are not the most important factor. Low access times, even while reaching the advertised 36x speed, were enough to cripple this drive. With a drive rating of 25.5x, we thought it was sure to rule the mountain, but it lost steam quickly when faced with real-world performance benchmarks, delivering a copy time five times slower than the competition.

AOpen's architecture is based on both Constant Angular Velocity (CAV) and CLV technologies, giving it a higher transfer rate on the inner and middle tracks by using CLV-based technology, and a higher throughput potential by using CAV-based technology on the outer tracks. Of course, the coupling of these two technologies may be what ultimately slowed it during the copy process. Burst rates were excellent, though, and digital audio extraction was handled adequately. It's a shame the drive couldn't deliver when removed from the CD Tach arena, for it would surely have been a contender.

The CD-936E may seem like a contender with its beefy throughput, but its weakness is its slow uppercut. Spend ten bucks more and get Sony's CDU711.

MAXIMUM PC VERDICT

Price $89
Company HiVal
Phone 714.953.3000
URL www.hival.com

5

Sony CDU711 32X

MAXIMUM PC KICK ASS! product

Sony has consistently addressed the shortcomings of technology with innovative solutions. With its 24x CD-ROM drive (CDU611), Sony fixed the spindle-vibration problem by using migrating ball bearings to help counteract unbalanced discs. But that drive couldn't reach the coveted 24x speed that was the threshold of the day. And although Sony didn't quite reach the 32x mark with its latest offering, delivering scores at the 31x speed, it did manage to release a remarkably sturdy and speedy drive that dominated in other areas.

Sony captured new records for the best full-stroke access time, random access time, CPU utilization, and interface burst speeds. These scores, evident in the chart with regards to the real-world copy test, are crucial for delivering content. Based on the CAV architecture, the CDU711 doesn't reach it's full potential until well into a disc and delivers data on the inside tracks at a 17x speed.

Although the drive didn't meet spec, it shined in too many other areas, including price, to be denied a Kick Ass designation. If an inexpensive upgrade is in your future, then look no further than Sony's latest offering. It delivers all the CD media support you'll need with performance that's top-notch.

The CDU711 is a true underdog. Its performance sets new benchmarks and proves that quality can be had at half the price. This drive is worth every penny.

MAXIMUM PC VERDICT

Price $99
Company Sony
Phone 800.352.7669
URL www.ita.sel.sony.com

9

THE SPECS

INTERNAL BUFFER
2MB

INTERFACE
Bus-mastering ATAPI (EIDE)

MEDIA SUPPORTED
CD-ROM Mode 1 and Mode 2 | CD-R | CD-Extra | CD-DA Audio | Photo CD (Single- and Multi-Session) | CD-I | Video CD | CD-ROM-XA and CD-G

Quantex QP6/400 SM-4x

An untuned fighting machine

The Quantex QP6/400 SM-4x is a damn fine gaming machine that deserves your attention. A few modifications are all that prevents it from kicking some serious ass.

Quantex enters the 400MHz battle with its sights set on the high-end gaming market. And what a machine this could be, with a slew of minor revisions. Using Intel's latest 440BX chipset, this hellion delivers at a 100MHz system-bus throughput. Real 3D's Kick-Ass StarFighter i740 videocard delivers full AGP 2x compliance with sidebanding, although it has only 4MB of onboard memory. So Quantex includes the Diamond Monster 3D II, a second-generation Voodoo^2 part. And for the truly hardcore, Quantex will happily include an additional Monster 3D II for $199 for SLI (scan-line interleave), doubling performance and raising the resolution ceiling.

2D is handled well and looks best at 1024x768 at a 24-bit color depth. Currently, higher resolutions look strained on the included 19-inch monitor, but a firmware revision for the StarFighter board and new drivers will address this.

But video isn't everything, so Quantex included Adaptec's 2940UW Ultra Wide SCSI host adapter connecting Western Digital's WDE 9100 9.1GB hard drive. This drive not only delivers at 13MB/sec, it also has a random-access seek of 8.5ms.

The SCSI board was configured improperly. The maximum transfer rate was set to only 20MB instead of 40MB. Changing it increased the burst from 15MB to 24MB, but reduced the seek to 12ms. We could only attribute this to the hard drive. DMA wasn't enabled on the Toshiba 32x CD-ROM drive either. Enabling it increased the drive rating to 20.9x and increased throughput on the outer tracks by a whopping 1,500K, or 10x. It also reduced the CPU utilization by 70%, even at higher speeds.

Quantex dissed the substandard Crystal CS4236B sound on the Intel SE440BX motherboard for Ensoniq's AudioPCI board. Though we consider this a step in the right direction, it still falls short. We would rather have seen a board that supports A3D and doesn't require the CPU for DirectSound3D acceleration.

We don't understand why Quantex included only 64MB RAM. With today's prices, it should have been a no-brainer to pack in 128MB to pad any hard drive file swapping.

Overall, this is a solid machine and would be an excellent gaming system with some changes. Quantex is proving it's sensitive to consumer needs and promises even more. Go A3D, add another Voodoo^2, 4MB on the StarFighter, and another 64MB of memory, and then you'll be set for at least the next six months.

—Sean Cleveland

PLUSES

- Ultra Wide SCSI hard drive
- Voodoo^2 madness
- PCI soundcard
- Competent AGP hardware

MINUSES

- No TV-out
- No Zip drive
- No gaming controller
- Drives not configured

UNDER THE HOOD

THE BRAINS

CPU	Intel 400MHz Pentium II Processor
L2 Cache	512K SBRAM internal
RAM	64MB SDRAM 100MHz (384MB max)
Motherboard	Intel SE440BX ATX
Drive Bays	Four 5.25-inch, five 3.5-inch
I/O Ports	Two USB, two serial, one parallel, and one gameport, internal 68-pin SCSI-3, external 68-pin SCSI-3, internal 50-pin SCSI

DISPLAY

Videocard	Real3D StarFighter i740 with 4MB of SGRAM Diamond Monster 3D II with 8MB of SGRAM
Monitor	Quantex XP190 19-inch with 0.26mm dot pitch and digital controls
Res/Refresh	1600x1200 with maximum of 256 colors at 60Hz

STORAGE

Hard Drive	Western Digital WDE 9100 9.1GB Ultra SCSI
CD/DVD	Toshiba XM-6202B 32x with 256K buffer
Removable	None
Fax/Modem	ViVa 56LC-SM K56flex internal fax modem

SOUND

Sound	Ensoniq AudioPCI S5016 wavetable soundcard
Speakers	Altec Lansing ACS-490 with ACS-160 subwoofer

THE BUNDLE

Windows 95 OSR2.1 | Softkey's Office Mate | Softkey's Power Business Plans | Softkey Project Manager Pro | Softkey's Key Day Planner | Softkey's Labels Unlimited | Compton's Complete Reference Collection | Form Designer Pro | Microsoft Office 97 Small Business Edition | Microsoft Automap Streets Plus | StarFighter Games Bundle

BOOT 1:08 DOWN 0:07

REAL WORLD BENCHMARKING

CPU/MOTHERBOARD bootMark		191
WIN95 APPS SYSmark 32		350
HARD DRIVE HD Tach	MB/sec	13.0
CD-ROM CD Tach98	K/sec	18.8
3D RENDERING Newtek Inspire3D	sec	559
DESKTOP PUBLISHING Adobe Photoshop 5.0	sec	130
DIRECT3D ForsakenMark	fps	58.6
OPENGL Quake2 v3.15	fps	56.0

MAXIMUM PC VERDICT

Price $2,999 ($2,799 without monitor)
Company Quantex
Phone 800.760.9001
URL www.quantex.com

9

Pumpin' Kilowatts Altec Lansing's ACS-490 satellites deliver excellent sparkle and midrange capabilities. The monotone sounding ACS-190 subwoofer has presence but lacks very deep lows.

EXPANSION NOTES

Quantex's choice of an Intel motherboard leaves little opportunity for expansion. Only one additional PCI slot is free with this configuration.

EXPANSION MAP

AGP	2D Videocard
PCI	3D Videocard
PCI	SCSI Card
PCI	Soundcard
PCI/ISA	56K Modem
ISA	None

IROS

00	System timer	08	System clock
01	Keyboard	09	USB controller
02	IRQ controller	10	Soundcard
03	Modem	11	2D Videocard
04	COM1 port	12	PS2 Mouse
05	OPEN	13	Num data proc
06	Floppy port	14	SCSI controller
07	LPT1	15	IDE controllers

DMAS

01	Soundcard	05	Open
02	Floppy controller	06	Modem
03	Open	07	Modem
04	DMA controller		

A Nice Phat Fan Check out the ultra-cool heatsink and fan. Don't let the heatsink's smaller size fool you. The CPU itself is only about that big inside its black case, and there's more than enough chillin' goin on.

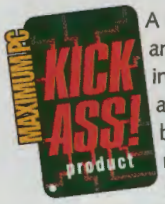
Room to Grow This spacious case offers mucho expando growth potential giving you the ability to add three additional hard drives, a DVD drive, CD-R, and even a sorely needed removable backup device.

Smart Bus Choices An Ultra Wide SCSI card and hard drive, and fast Toshiba 32x IDE CD-ROM drive guarantee that data won't have to wait for a free bus. All the gaming data you require will be at your call with nary a drop in framerate.

What is this? A fan housing sans the fan? Good airflow is a panacea, especially when a hot burning Voodoo^2 card is present. An additional five bucks would've solved this.

Poser 3

It does a body good



A redesigned GUI, enhanced and more realistic modeling/ animation features, and motion-control capabilities are among the numerous enhancements built into *Poser 3*, an application that provides posable 3D human figures that can be saved as 2D illustrations, animated movies, and 3D characters to use in other applications.

THE SPECS

REQUIREMENTS
Pentium or higher
Windows 95, NT 4.0
64MB RAM
80MB hard disk

PLUSES
- Enhanced models
- Speedier model redraw
- New, fully-articulated hands
- Improved keyframe animation capabilities
- Realistic textures

MINUSES
- Difficult to create individualized models
- Easy to break IK chain
- No right mouse button shortcuts

Cosmetically, *Poser 3* is completely redesigned. The Kai-like user interface, which we've seen in products such as MetaCreations' *Bryce* and *Goo*, looks intuitive, but takes a while to get comfortable with. But we found the new set up of palettes and pullout drawers practical and useful. And you can now grab libraries, palettes, or windows, move them wherever you like, then save the setup as a new default.

Poser 3's eight new models are more realistic and anatomically detailed than those of *Poser 2* (which are also included). You get a Caucasian male, female, and child. *Poser 3* also has a human skeleton and adds models for a dog, cat, horse, dolphin, and, get this, a Velociraptor. The SREE renderer shows models with *Bryce*-like photo-realism. Other rendering styles include wire frame, silhouette, outline, and sketch. The new models also have higher polygon counts. For example, the male adult has 17,000 polys, 7,000 more than version 2.

Poser's revamped interface puts all your tools within reach. The "handles" at the bottom and right of the screen give you access to your Animation and Library palettes.

But this enhancement doesn't come without a performance hit. Using a 233MHz P-II with 32MB RAM, we timed the default model from each version at two resolutions, with anti-alias, shadows, and bump and texture maps turned on. At 1024x691, *Poser 2* rendered one frame in 22 seconds, while *Poser 3* took 29. At 720x486 it took 14 seconds, while *Poser 3* took 16. Animating a movie still takes anywhere from minutes to hours, depending on the resolution and the number of frames in your animation.

However, you can preview your work in realtime using the wireframe view.

After you've selected a figure (or figures) for your scene, you can double-click a preset in the library of poses to have it snap into place, or do it yourself by clicking and dragging the body part you want to adjust. You can bend limbs, twist the waist or spine, tilt the head, spin the whole body, and raise it off the ground. Move the whole body up, down or side to side, or rotate it to any angle. You can also click on any body part to extend, turn, or expand it.

ANIMATING A FIGURE WITH REALISTIC MOTION

▶ After you've chosen a model and imparted him/her with hair and a facial expression, import a motion capture file, found on the Poser CD in the Cool Stuff In Here folder. Poser automatically adds the frames required for the motion file.

▶ Some dance motions will move the model well outside of the normal camera view. By switching to the Posing camera, you can choose a view that stays on the model as it moves.

▶ Before animating, make sure the capture sequence and camera view work properly by clicking the play button at the bottom left-hand side of the screen to see how a rough view of the model goes through the motions.

Movement is realistic. For example, if you drag out a hand, the forearm, shoulder, and eventually entire torso move along with it. Tip: Perfectionists who tweak and re-tweak a character's pose can end up breaking the inverse kinematics (IK) chain. To fix this, select the area of the body that's been destroyed and hit Control-E repeatedly to slowly transform the ruined section to its original state.

The Kai-like interface is easy on the eyes, but it takes some getting used to.

Thanks to the improved rendering engine, character updates redraw in seconds.

You're not limited to the look of the provided models: you can reshape individual body parts, resize the whole figure or change its proportions, change the colors, and add textures. But we found it difficult to customize a pre-built figure. For example, to make two women in one scene have individualized weight, height, body shape, and facial characteristics was a painstaking task of individual part selection and numerical-entry modal dialog boxes. Pull-down settings, a dialog box, or some other series of presets should handle this.

While you're better off exporting *Poser* figures to a more robust 3D program to create complicated scenes, you can make simple arrangements. To add realism and drama to your project, you can choose from a relatively small assortment of 19 objects (glasses, furniture, and such), adjust three provided light sources, and move up to 10 cameras. *Poser* can can also import models in standard 3D formats such as DXF, OBJ, and 3DMF—with textures, if available. You can export *Poser* models into other 3D applications, but you will lose your textures.

Poser's new cartoon-drawing rendering style can produce instant comic book illustrations and movies with a hand-drawn look.

When you're ready to animate, you'll be happy to know you don't have to tediously move each body part on a frame-by-frame basis. *Poser 3*'s keyframe animation utility is easier to use than version 2's. All you need to do is set a few key poses, and the software fills in the blanks. For example, you can sit a figure in a chair, set a key frame, stand the figure up, then set a second key frame, and *Poser* will animate all the frames in between.

Other new features include redesigned hands with 18 movable joints, the ability to import and assign prerecorded motion files to your models, adjustable eyes, brows, and lips, a mouth you can animate to lip-sync to WAV files, and sound with phonemes for realistic speech. Finally, the whole thing works remarkably fast: screen refreshes of a figure that took upwards of seven seconds in *Poser 2*, redraw instantaneously now.

The only limitations we found in *Poser* are that renders cannot exceed 4090x4090, and the application failed to implement any type of right-button mouse shortcuts. However, these limitations can be easily overlooked because the application is just so much fun to play with.

If you're really into making custom models, MetaCreations provides plug-ins and a downloadable manual for using its own *Ray Dream 5* to do so. *Poser*'s supplied texture maps for the figures are excellent, and templates are included for making your own textures in a paint program.

Rarely do apps deliver pro-caliber capabilities and customizable controls along with an interface anyone can understand. We give MetaCreations high marks for developing a creative application that's both powerful and inexpensive.

—Paul Worthington

MAXIMUM PC VERDICT

Price $199/Upgrade $199
Company MetaCreations
Phone 800.846.0111
URL www.metacreations.com

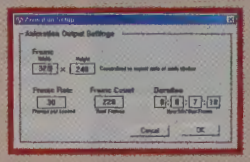
9

WALK LIKE A MAN

▶ The Walk Designer lets you quickly create character walk patterns. Go to the Figure menu and selecting Create Walk Path. Grab the guideline on the floor in front of your character to adjust its direction and speed.

▶ Next, From the Window menu, select Walk Designer. This brings up a box that lets you tweak your character's walk.

▶ When you have your character's walk just right, hit apply, bringing up the Walk Apply dialog box. Choose 220 frames and leave everything else at its default. From the Animation menu, select Animation Setup and leave everything at its default.



▶ To composite your animation in an editing app such as *Premiere*, change your character's background to blue and get rid of the motion path guidelines.

▶ Next, under the Animation menu, select Make Movie, and name your flick. Select compression type. When the animation's finished rendering, a media player will pop up showing you the finished animation.

Soundcard Revolution

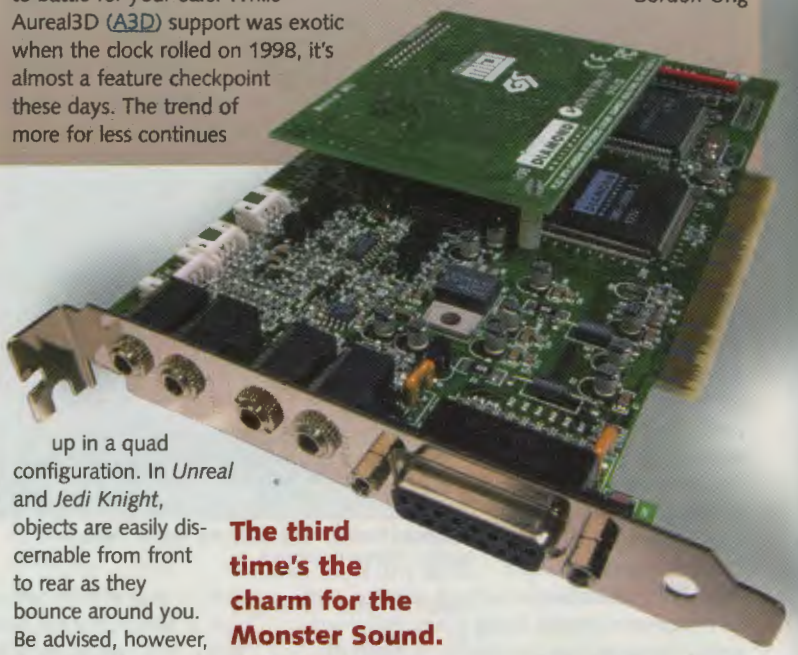
Now hear this!

The ISA bus is dead, it just doesn't know it yet

The thousands of PC owners who will soon be ISA bus-less should look no further than their PCI bus to plug in next-generation soundcards. Offering ten times the throughput, bus mastering, and better plug-and-play support, a PCI soundcard plays silver Corvette to an ISA-based Gremlin.

Now three PCI cards leap forward to battle for your ears. While Aureal3D (A3D) support was exotic when the clock rolled on 1998, it's almost a feature checkpoint these days. The trend of more for less continues as all the cards feature hardware wavetable, PCI 2.1, and DirectSound and DirectSound3D support.

—Gordon Ung



Diamond Monster Sound MX200

MAXIMUM PC KICK ASS! product

Even in junior high school you could spot the kid who would go places. The Diamond MX200 is that kid.

The third in the Monster Sound series, the MX200 finally knocks the ball out of the park with such features as a 4MB Roland MIDI patch in ROM, 64-voice hardware wavetable, and quad-speaker support in A3D.

PLUSES
- Roland MIDI Sample quivers your ears
- Quad-speaker support in A3D
- Tray-applet options for days

MINUSES
- No real-mode DOS support
- Gags on some digital joysticks
- No NT or DLS support yet

Diamond still conservatively covers its bets by emphasizing that the MX200 does not offer real-mode DOS support. To handle that task, Diamond recommends that you plug the supplied Monster Cable to your legacy Sound Blaster card for full DOS support. We say, who cares? It's time to shed those moldy old DOS games.

Plug that beautiful gold-plated Monster Cable from your TV tuner to your Monster Sound input and install only Diamond's DOS drivers if you want to pretend President Bush is still in office. But be advised, the Monster's Sound Blaster support eats a total of three IRQs. It sheds two of those IRQs if run without the support.

Sound processing is left up to an Analog Devices 2181 DSP (a 40 MIPS DSP). Although the A3D algorithms are designed to support two speakers, Diamond tweaked the A3D drivers to add the quad support, so the sweet spot opens up in a quad configuration. In *Unreal* and *Jedi Knight*, objects are easily discernable from front to rear as they bounce around you. Be advised, however, that while the quad support makes you salivate, it's at the expense of elevation. The card will also process DirectSound and DirectSound3D.

The third time's the charm for the Monster Sound. Offering quad-speaker support with top-notch Roland MIDI patches in ROM, the MX200 is a tough card to beat if you're finally willing to lose those old DOS games.

The MX200's main weaknesses are Diamond's inability to support the two Thrustmaster digital sticks and not providing enough input headers on the card for multiple peripherals. The MX200 also sports dual speaker outs and two inputs, as well as a joystick/MIDI connector on the bracket. The 1/8-inch plugs detect when a speaker is plugged in, and a tray applet lets users select either quad or speaker and headphone configurations.

The MX200 doesn't have DLS support yet because nothing uses it yet, Diamond says. A DLS-compliant software wavetable will be added only if developers support it. NT support didn't come in the box, but Diamond promises drivers shortly. The excellent Roland 4MB patch is upgradable and turned in the best MIDI of this roundup. Inside it has connectors for CD-ROM, aux, and modem, but no S/PDIF. Diamond skimped on hard copy, preferring to leave docs in HTML format on the CD.

Although it may offer the steepest price of the bunch, the MX200 offers the best bundle, along with the 64-voice hardware wavetable and eargasmic Roland MIDI samples in ROM.

Now all grown up, this kid kicks butt and takes names too.

THE SPECS

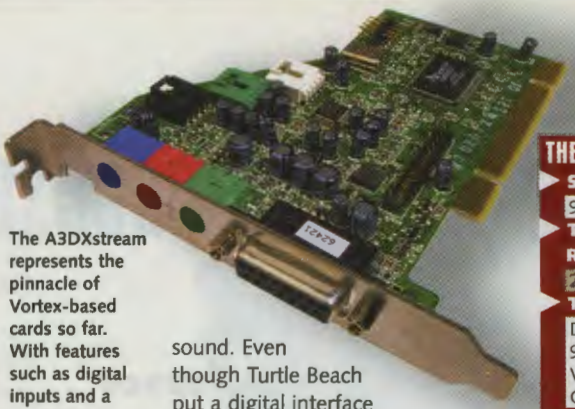
SIGNAL/NOISE RATIO	90dB
TOTAL FREQUENCY RESPONSE	20Hz–20kHz
THE BUNDLE	Drivers for Windows 9X | Dark Forces II: Pathways to the Force | Rage Incoming | Outlaws | Midisoft Studio Recording Session

MAXIMUM PC VERDICT

Price $149
Company Diamond Multimedia
Phone 468.584.6334
URL www.diamondmm.com

9

Montego A3DXstream



The A3DXstream represents the pinnacle of Vortex-based cards so far. With features such as digital inputs and a wavetable header, the Montego doesn't mess around.

THE SPECS

SIGNAL/NOISE RATIO
92dB

TOTAL FREQUENCY RESPONSE
20Hz-20kHz

THE BUNDLE
Drivers for Windows 3.1 | 9X, NT 4.0 and 5.0 | Voyetra Software Suite | OEM version of Battlezone

It's junior high again and Aureal3D sound support is the equivalent of brown corduroy slacks. Wear them or feel out of place. Then you realize you're just like everyone else. To be different, you part your hair to the left.

Turtle Beach has taken the time to primp the Montego just enough to make it stand out in a crowd of Vortex-chip Me Too's, but it didn't go overboard and pierce its nose. Sure it has A3D, and DirectSound and DirectSound3D acceleration like all the others, but Turtle Beach included a S/PDIF header for digital in and out, and a Waveblaster-compatible header.

Lining the bracket are color-coded, 1/8-inch jacks for speaker or headphone outputs, stereo and microphone inputs, and the MIDI/joystick connector. The PCB has connectors for a CD-ROM, a modem, and an auxiliary input for items such as a CD burner or TV tuner.

The Sigmatel 9701 codec's 18-bit ADC and DAC promise crystal-clear sound. Even though Turtle Beach put a digital interface header on it, this card will really appeal to gamers. It knocked down two of three digital joysticks, failing to detect only the Thrustmaster Rage3D.

The 4MB MIDI patch resides in RAM and voices good neutral instruments, albeit with horns on the synthetic side. The Montego pumps out 64 voices, with 32 handled by the hardware wavetable. An applet common to Aureal-based cards lets users switch between 32, 64, and game or pro modes.

The only real problems with the card relate to the Vortex chip itself, such as an inability to vary the size of the MIDI patch. All the Vortex cards we've seen so far wake you up by making a loud popping noise when booted up. The final hitch, which also affected both Vortex cards here, was a slight distortion heard during a particularly heavy battle in ForsakenMark.

Although the card didn't sweat through most of our tests, it did exhibit the highest CPU utilization when we tossed 24 wave files at it. The score could be a result of the inaccuracy of System Monitor.

While the price is steep, the Montego distinguishes itself enough to satisfy your aural needs.

MAXIMUM PC VERDICT

Price $129
Company Turtle Beach
Phone 800.233.9377
URL www.tbeach.com

9

PLUSES
Nice software bundle and docs
Wavetable header
S/PDIF connector

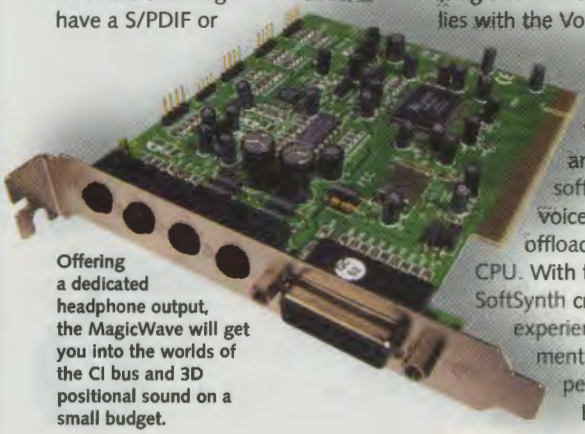
MINUSES
Not enough input connectors

MagicWave PCI

We're still wearing those brown corduroys, but we've slicked the hair back, and we're chewing on a toothpick. I/O Magic's PCI Vortex-based card takes a different tack.

Sure, it has DirectSound, DirectSound3D, and A3D support pumping from the same 8820 Vortex (a 300 audio MIPS DSP). But I/O Magic went a different way with Analog Devices' AD1819 CODEC and had to live with a 16-bit DAC and ADC, and a worse sound-to-noise ratio.

While the MagicWave doesn't have a S/PDIF or wavetable header, it is connector heaven. Adding to the standard speaker-out, mike-in, and MIDI/joystick ports, the MagicWave has a second nonamplified line-out for headphones. Internally, I/O Magic has headers for two CD-ROMs, video, aux, and a telephone connector. A jumper is included for different joystick types, but it couldn't get the Thrustmaster Rage3D to work. I/O Magic confirmed that the problem lies with the Vortex itself.



Offering a dedicated headphone output, the MagicWave will get you into the worlds of the CI bus and 3D positional sound on a small budget.

THE SPECS

SIGNAL/NOISE RATIO
90dB

TOTAL FREQUENCY RESPONSE
20Hz-20kHz

BUNDLE
Drivers for Windows 3.1, 9X, NT 4.0 and 5.0; Voyetra Audio Station; Dark Forces II: Ambush at Altyr 5 Demo

To bolster the stock 4MB MIDI patch, I/O Magic threw in Yamaha's S-YXG50 and S-YG20 SoftSynth software. It ups the voices another 128 by offloading to the host CPU. With the Yamaha SoftSynth cranked to 128, MIDI experienced a mild improvement, but you'll take a performance hit.

Both real-mode and DOS-in-a-box support were there, and the card breezed through our test. The annoying pop-crackle-fizzle on boot-up was also present. And installation was the fuzziest of the three cards here, although the printed docs were excellent and informative.

Our main beefs relate to the Vortex and the sparse MIDI and sound applications. And although I/O Magic pushes the feature of simultaneous speaker and headphone support, you still have to open the tray applet to switch 3D algorithms between headphones and speakers.

While the card won't be as quiet as the Montego, trading the S/PDIF and wavetable header to save about $50 lifts the MagicWave into popularity.

MAXIMUM PC VERDICT

Price $79
Company I/O Magic
Phone 714.727.7466
URL www.iomagic.com

8

PLUSES
Connectors aplenty
Good documention

MINUSES
Skimpy software bundle
Two line outs but no quad support

CAPITAL SHIP COMBAT 101

When the orders come down to take out some lumbering destroyer, there's a sweet science to adding one of these bad boys to your kill list.

- Expect a heavy fighter escort when facing any capital ship. When you warp into a combat situation, quickly assess how many enemy fighters are present by cycling through available targets (pressing [T] repeatedly). Lock onto a group, then command a wing to attack.
- Never go after a capital ship alone—it's suicide. Once you've taken out the initial fighter cover, target one of the cap ships, then press [S] to target individual parts of the ship—go for the turrets to strip a cap ship of its defenses and target the engines to stop it in its tracks.
- As you make your attack run, the cap ship will defend itself. Instead of flying in a straight line, jinx about and avoid their fire. If you've obtained a clean lock (look for a red square in your HUD), fire off a missile to make short work of the defenses. Once a couple of turrets are down, call in your posse to attack the target.
- Always be on the lookout for incoming enemy fighter reinforcements. Your wingmen will scream something like "Head's up, we've got company!" If your wingmen are knee-deep in the cap ship attack, break off your own attack and take care of the enemy fighters personally. If you don't, your wingmen will be cut to ribbons.

Descent Freespace: The Great War

Down and out in outerspace

MAXIMUM PC KICK ASS! product

The only things that made the jump from Interplay's tunnel-dwelling original to its awe-inspiring sequel, *Descent Freespace: The Great War*, are the devious AI and nauseating freedom of movement. In fact, this explosive first-person space-combat sim more resembles Origin's *Wing Commander* series.

Once again, three races fight an epic interstellar war, and you, as a lowly Galactic Terran Alliance fighter pilot, are called in to work your space-combat skills against an enemy flying equally deadly starfighters.

If you thought *WCP*'s visuals made your hardware sweat, *Freespace*'s intense firefights knock you around and set your 3D accelerator on fire. Limited to 640x480, *Freespace* will frustrate hardcore D3D/Glide owners who yearn for a higher res, but the results are still audacious. Space combat explodes across your screen in rich 16-bit color; today's burliest systems deliver locked-in 30fps+ with the appropriate 3D accelerator.

In Descent Freespace, this Terran carrier is a behemoth. Capital ships are tough to take down, but not impossible.

THE SPECS

3D CARD SUPPORT
Direct3D
Glide
SOUND CARD
DirectSound Force-feed back
MULTIPLAYER
TCP/IP
modem
IPX

With obligatory lens-flaring, excellent sprite-based explosions, semi-transparent shield effects, and alpha-blended engine glows, special effects galore adorn *Freespace*. Turning-and-burning in space, you notice the attention to detail: point-specific damage, sparks spewing from damaged craft, slow-spinning wreckage, motion-blurs on turns, the tremble of the cockpit (and the wiggle of a compliant force-feedback stick) when you kick the afterburner.

PLUSES

- A grand space combat simulation in the Wing Commander tradition
- Excellent visual effects with massive capital ships
- Intense gameplay
- Real-time voice over multi-player

MINUSES

- No resolutions past 640x480
- Some cut-scenes kinda hokey

The ships are the stars here. Each craft's been meticulously detailed and texture-mapped, with nary a repetitive texture among them. *Freespace*'s intricately detailed capital ships are so huge, it literally takes minutes to cruise across the biggest ones. And it will take the combined efforts of you and your wingmen to take these leviathans down. But when they do go down, you're treated to a painful capital ship death worthy of a *Babylon 5* season finale—something *WCP* failed to do.

An enemy fighter's about to get a taste of your twin lasers.

Rich sound effects and an action-dependent soundtrack set off an enemy AI (optimized from the original *Descent*) that bobs and weaves just enough to keep you on your toes, while capital ship hunting requires skillful dodging and attacking. Plus, the multi-threaded nature of each mission means each combat run is totally different. If enemy freighters sneak past your ambush and manage to warn their friends, expect a fierce firefight. Destroy them, and the mission's complete. Also, not everything needs to be destroyed; new technologies await those who capture enemy fighters.

Descent Freespace is the absolute best space-combat sim to date.

—Andrew Sanchez

MAXIMUM PC VERDICT

Price $50
Developer Volition/Parallax
Publisher Interplay
Phone 800.INTERPLAY
URL www.interplay.com

9

Iomega Buz

DV for the masses

The buz's funky break-out box allows you to attach both composite and s-video sources to your PC and play junior movie mogul.

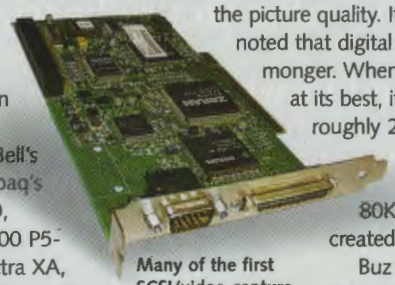
Iomega's Buz Multimedia Producer is an easy-to-use video capture/playback solution that's perfect for novice users. Without a sophisticated software editor and the ability to crank the data rates beyond 3MB/sec, savvy producers may thumb their noses at Buz, but first timers will relish being able to learn the system and create their first project in less than an hour.

Despite being eminently user-friendly and affordable, Buz has its problems. The video-capture and out-put quality is barely passable, and severe installation problems plague the system. What Buz has going for it is that it's cheap.

In addition to an Ultra SCSI port built into the card for capturing video to an external hard drive, Buz comes with a breakout box with composite and S-Video input/output, and audio pass-through jacks for quickly hooking up your video devices. Buz actually uses your computer's soundcard to capture audio. The package contains RCA A/V cables, but not an S-Video or SCSI cable.

Also included is MGI's *VideoWave SE*, mediocre video-editing software for chopping and gluing your clips together. *VideoWave* has just enough features to whet a budding producer's appetite, but after only a few minutes, we found ourselves yearning for something meatier, such as Ulead's *Media Studio Pro* or Adobe's *Premiere*.

We tested Buz on a variety of systems from Compaq, Micron, and Dell, with varying degrees of success. Sometimes it worked, sometimes we got the blue screen of death. Iomega tech support blamed the problem on Phillips' touchy btD9801V1 chip. If your Buz board has this chip on it, call Iomega for an exchange. Also, there are compatibility issues with BIOSes that don't support PCI-to-PCI bridge chips as outlined in the PCI 2.1 specs (such as Packard Bell's 860CD, Compaq's Desktop 6150, Gateway's 2000 P5-100, HP's Vectra XA, and IBM's Aptiva built before 8/1/97). We finally got Buz working in an NEC Direction PCL 333 with 32MB RAM and a 9GB Seagate Cheetah (capable of sustaining 16MB/sec).



Many of the first SCSI/video-capture boards provided with buz are plagued with a faulty chip that leads to random crashes. Contact Iomega for a replacement if you're a victim.

Buz captures video at resolutions ranging from an Internet-friendly 176x120 and TV-output 720x480 at 30fps. Audio can be set between 11kHz 8-bit mono (AM radio quality) and 44.1kHz 16-bit stereo (CD quality).

At the highest setting (100K per frame), we dropped frames. When we dropped to 90K, we dropped fewer frames, but the picture started to strobe about two minutes into the clip. Sliding the quality bar down to 50K improved it, but introduced significant artifacts. Overall, we wouldn't entrust Buz to capture video clips longer than three minutes. After that, Buz peters out, resulting in jittery clip playback.

You don't need a Fast SCSI drive to use Buz. Your internal IDE hard drive will work, but it won't capture the data rates that a good SCSI card will. And when you're talking video quality, the higher the data rate, the higher the picture quality. It should also be noted that digital video is a space monger. When Buz is humming at its best, it's munching roughly 2.6MB/sec. Our three-and-a-half minute clip at the 80K-quality setting created a 490MB file.

Buz works for consumers who want to dabble in digital video without shelling out serious dough. If high-quality output to videotape is what you're after, save your money and buy Pinnacle System's miroDC30 Plus.

—Rick Popko

THE SPECS

VIDEO	
720x480	30fps
AUDIO	
Through soundcard	
REQUIREMENTS	
Pentium 100MHz	
Win95	
16MB RAM 80MB HD	
RECOMMENDED	
A/V HD	
32MB RAM	

PLUSES

- Inexpensive
- Outputs captured video to television
- Includes thorough tutorials
- Well-designed breakout box
- Built-in SCSI card

MINUSES

- Requires separate soundcard for audio capture
- Capture tops out at 3MB/sec
- Does not include S-Video or SCSI cabling
- Mediocre bundled software
- First Buz's shipped extremely buggy
- BIOS incompatibilities

10 TIPS FOR BETTER DIGITAL VIDEO CAPTURE

- A high-quality source (such as a Hi-8 camera) results in better captures. Avoid duped tapes.
- Use a SCSI drive that's been specially optimized for video.
- Run Scan Disk and Disk Defragmenter before installing the software.
- Disable crash recovery, anti-virus shields, screen savers, and anything else running in the background.
- If you're on a network, disconnect.
- Use S-Video over composite, if your video player/recorder supports it.
- If you're using 32MB RAM or less, upgrade to at least 64MB.
- In Control Panel folder, go under System Properties/Performance/File System and change read-ahead optimization to "none."
- While still in the File System property box, check the Troubleshooting tab and disable write-behind caching.
- Under System Performance/Virtual Memory, Disable virtual memory.

MAXIMUM PC VERDICT

Price $199
Company Iomega
Phone 800.697.8833
URL www.iomega.com

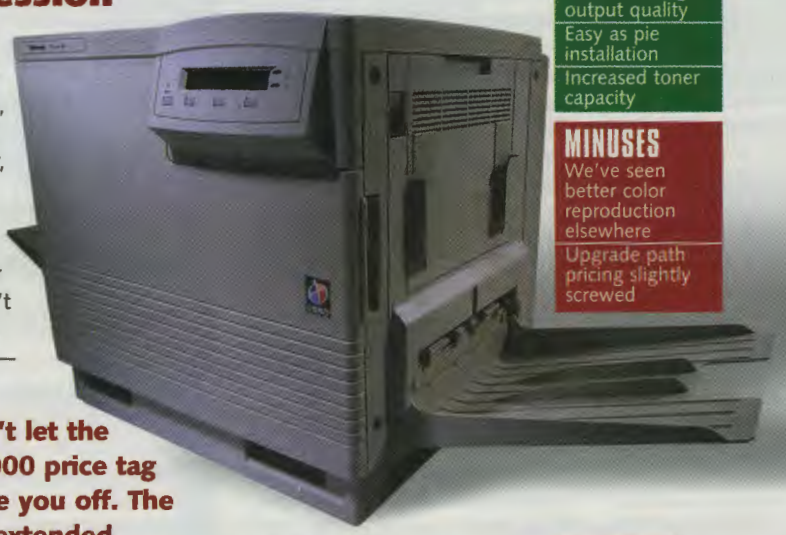
6

Tektronix Phaser 560

Makes a colorful impression

PLUSES
- Above-average output quality
- Easy as pie installation
- Increased toner capacity

MINUSES
- We've seen better color reproduction elsewhere
- Upgrade path pricing slightly screwed



If you're willing to drop more than a few thousand dollars on printer, chances are you're either (a) loaded to the gills with bills for thrills, or (b) looking for something with quality. If it's quality you're after, nothing beats a good laser, and the Phaser 560 doesn't disappoint.

With a 33MHz AMD RISC controller delivering genuine Adobe PostScript processing, Tektronix claims print speeds of up to 5ppm for color and 14ppm for black and white. We didn't get anywhere near those speeds ourselves, but then our tests were designed to tax the printer—not give it an easy workout. Nonetheless, the Phaser 560 produced some darn good results in the process.

Output quality, especially with text and grayscale images, was impressive. Edges were sharp and crisp, with the text smooth and with nice, thick black lines. Photographic reproduction was also good: colors were bright and brilliant and fully saturated, with only minor dithering apparent in both our 600dpi and 1200dpi tests. Banding was almost nonexistent, even when printed on transparencies or glossy stock. We did have to adjust the color calibrations slightly (magenta levels were too high for our liking), but you can also modify the settings to perform customized color matching or simulate standard Pantones. You can even adjust the toner density.

Don't let the $5,000 price tag scare you off. The nonextended version (maximum 600dpi, 8MB RAM, less fonts,) costs $1,000 less, and you can still upgrade later—but at a price penalty.

Looks aren't everything, mind you, but inside the Phaser 560 is just as impressive. Automatic color correction, job pipelining, toner supply "gas gauges" that let you check the toner supply from either the front panel or from your web browser, and four separate paper trays for a variety of paper sizes and stocks are a few of the Phaser 560's features.

Installation is a breeze. Slide in the four starter toner cartridges, install the fuser and imaging unit, and attach the cables. And with a toner capacity twice that of standard laser printers, the cartridges won't have to be replaced until you've printed approximately 10,000 color pages or 12,000 monochrome. So, depending on your printing regimens, you may not have to buy replacement cartridges ($109 black; $299 color) for a while.

If it's a laser you're after, consider the Phaser 560. It's a colorful contender.

—Bryan Del Rizzo

THE SPECS

MAX RESOLUTION	1200dpi
RAM	40MB
RESIDENT FONTS	39
CONTROLLER	AMD 33MHz RISC
CONNECTIVITY	Parallel port, SCSI, Ethernet (EtherTalk, Novell NetWare, TCP/IP), Token Ring (Novell NetWare, TokenTalk, TCP/IP), Serial and LocalTalk
COLOR STANDARDS	Pantone and Adobe PostScript
HEIGHT/WEIGHT	18.2-inches/105lbs.

MAXIMUM PC VERDICT

Price $4,995
Company Tektronix
Phone 800.835.6100
URL www.tek.com

8

PRINT QUALITY

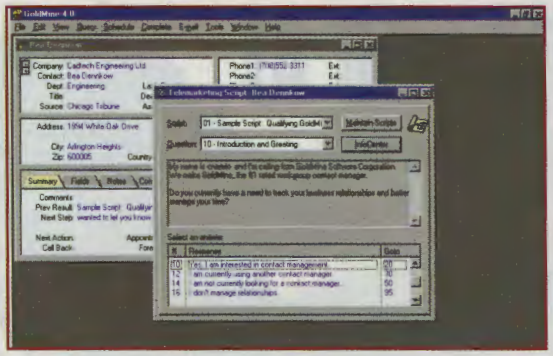
Print Time: 0:29
Text can't look much better than this.

Print Time: 4:27
If we'd printed these in color, they would've been good enough to open up a Swiss bank account with!

Print Time: 2:35
A sweet, not sour, reproduction

Goldmine 4.0

Everything but the prospect's kitchen sink



Not all contact managers are created equal. With *Goldmine 4.0*, you can manage your contacts, automate sales activity processes, and even create telemarketing scripts. Much of its power, however, is most fully realized in a networked environment, and you'll have to climb a steep learning curve to make the most of it.

Goldmine resembles most contact managers: a contact screen (importing records is a snap), calendar, and reminders. It's easy to sort contacts, gather them into groups, and search. The calendar has a strong networked presence, with an in/out pegboard and the ability to view several schedules.

Goldmine offers a variety of sales tools, including a telemarketing script organizer.

With its sales-specific features, *Goldmine* stands out. In addition to scheduling appointments, phone calls, and so forth, You can forecast sales (complete with probability percentage) and express these and other completed tasks in graphs.

Goldmine can you script processes that initiate normal actions in a sales cycle—sending a "thank you" letter, requesting referrals, surveying customers. *Goldmine* also has a solid e-mail. Incoming e-mail can be linked to contact records.

Telemarketing scripts, the ability to change sales territories, and other sales-type extras fill in this program. But it'll take you a while to get your bearings with all the icons and screens. Sometimes a fortuitous right-click or tap on the space bar will get you where a menu perusal couldn't. And this manager is so network-oriented that using it solo may seem a strange. But you'll find that there's a lot of power inside this initially overwhelming interface.

—Tara Calishain

THE SPECS

WHAT YOU NEED
486SX or higher IBM PC-compatible
25MB hard drive space
16MB RAM
Windows 95 or NT 4.0
DOS 3.1 file and record-locking compatible network
RECOMMENDED
Pentium 133MHz or higher IBM PC-compatible
32MB RAM

PLUSES
- Good Internet integration
- Tracks extensive information
- Good sales tools

MINUSES
- Steep learning curve
- Network-oriented

MAXIMUM PC VERDICT

Price $295
Company Goldmine
Phone 310.454.6800
URL www.goldminesw.com

8

LapLink 7.5

LapLink links computers—eventually

LapLink 7.5 exchanges information between computers—once you manage to get them connected.

LapLink links via cable, wireless, modem, network, or dial-up. We had a heck of a time hooking our laptop and desktop computers, until we learned our U.S. Robotics modems don't get along well with *LapLink*.

LapLink offers file transfer (it's set up like the Windows 95 Explorer), remote control, and a simple text chat. The excellent remote control offers full access. You can control the host computer remotely at full-screen on the guest computer or within a window.

LapLink's security, unfortunately, needs improvement. Though it's easy to set up users for a log-in list, when you add or edit a user, the password isn't shielded by asterisks and is clearly visible. Users can be given restricted access to the remote computer, limited only to chat, file transfer, remote control, or any combination. *LapLink* also offers logging of several interactions, including connections, file transfers, and callback numbers. Unfortunately, details about file transfer are made available only on the "guest" machine that downloads the files, and not the host machine.

File transfer is easy with LapLink, but use Xchange Agent if you need to synchronize file contents.

If you do a lot of remote computing, *LapLink* offers an easy way to get all your computers working off the same data.

—Tara Calishain

THE SPECS

WHAT YOU NEED
Windows 95 or 3.1
Intel or compatible 386DX 33MHz
8MB RAM
7MB hard disk space

PLUSES
- Excellent remote control
- Easy file synchronization
- Handy file transfer

MINUSES
- Incomplete security
- Modem compatibility problems

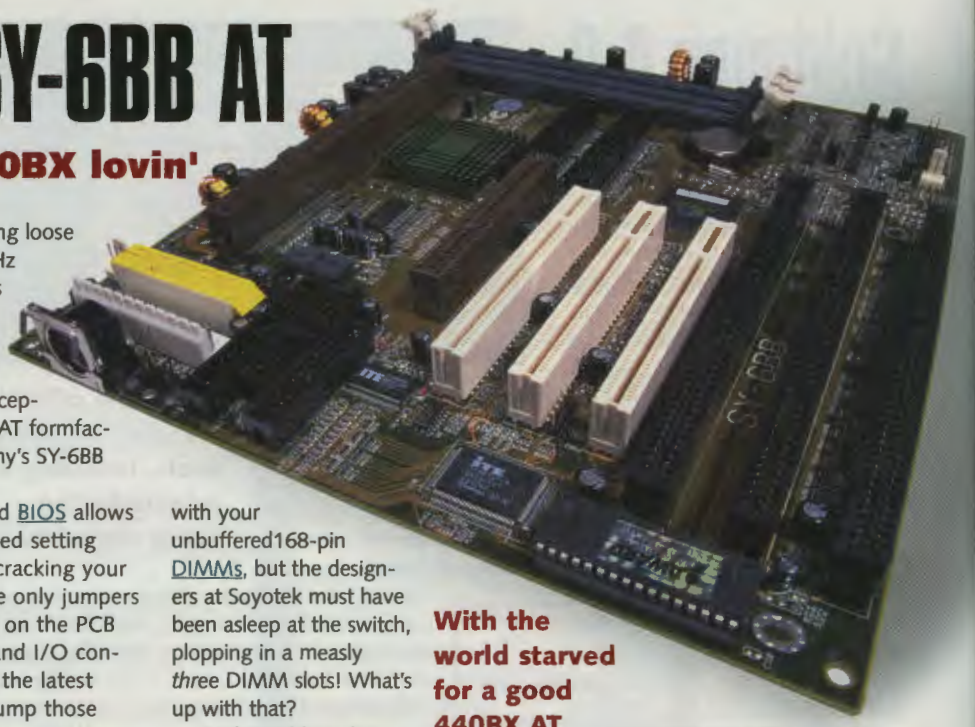
MAXIMUM PC VERDICT

Price $150
Company Traveling Software
Phone 425.483.8088
URL www.travsoft.com

7

Soyo SY-6BB AT

Anemic 440BX lovin'



PLUSES
- Clock settings accessible via BIOS
- Several system-bus settings for overclocking
- Solid performer
- AT formfactor

MINUSES
- Only three PCI slots
- Only three DIMM sockets
- No USB brackets packaged with board
- Odd positioning of EIDE header connectors

THE SPECS

FORM FACTOR	SY-6BB Baby AT
# OF AGP/PCI/ISA	1/3/3
BIOS	Award
# OF DIMM SOCKETS	3
MAXIMUM RAM	768MB

With Intel finally busting loose the the mighty 100MHz system bus, everyone's working that 440BX core-logic AGPset like it's going out of style. Soyotek is no exception; attacking on the AT formfactor front is the company's SY-6BB Baby AT board.

A jumperless Award BIOS allows cranking the CPU speed setting adjustments without cracking your case open. In fact, the only jumpers waiting to be jumped on the PCB are the CMOS reset and I/O configurations. And with the latest BIOS revs, you can bump those system-bus speeds from 66MHz, 100MHz, 103MHz, 113MHz, and a burly 133MHz—très bon!

Support for the Celeron and all flavors of Pentium II (from 233MHz through 400MHz) is also present and accounted for.

The SY-6BB will only run with your unbuffered168-pin DIMMs, but the designers at Soyotek must have been asleep at the switch, plopping in a measly *three* DIMM slots! What's up with that?

With the world starved for a good 440BX AT motherboard, why couldn't Soyo slap in just a few more sockets, slots, and ports for us?

And to add insult to injury, the SY-6BB only comes with three PCI slots, for a total expansion limitation of six slots. Hmmm, AT's standard layout calls for a hearty eight expansion slots. Soyotek could have easily slapped in the two more PCI slots this board desperately needs. We understand the need to keep some slots free for PS/2 and USB connectors, but come on!

The EIDE header connectors are also in a closer-than-comfortable position, straddling either side of the AGP expansion slot. The lack of any USB ports hurts as well—would it have hurt to include the necessary connector?

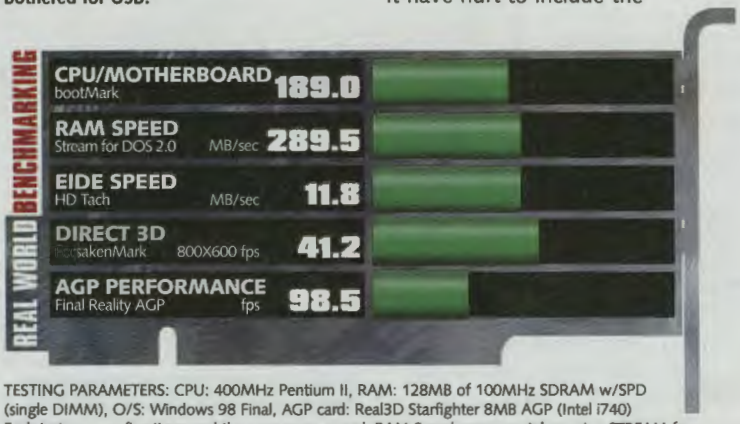
The accompanying CD-ROM contains all the Soyo manuals in PDF format, which may save paper, but makes them a pain to read if your only system is in pieces.

Performance wise, the SY-6BB is rock solid, and with the jumperless design, overclockers will have a field day bumping and nudging the mainboard into higher performances, thanks to no less than three other system-bus speeds. 350MHz CPU owners will be able to bump this rig up to 360MHz (103MHz x 3.5) or 395MHz (113MHz x 3.5), but as always system stability may be compromised at the higher speeds.

Slap more PCI slots, DIMM sockets, USB ports in the SY-6BB, and it might achieve Kick-Ass status. As it is, as one of only two 440BX AT motherboards making the rounds today (Tyan's Thunder 100 being the other), it *will* find a home in someone's older case. The SY-6BB performs superbly, and it is easy to overclock.

—Andrew Sanchez

All the usual suspect ports are present and accounted for on Soyo's SY-6BB AT motherboard, but don't get hot and bothered for USB.



TESTING PARAMETERS: CPU: 400MHz Pentium II, RAM: 128MB of 100MHz SDRAM w/SPD (single DIMM), O/S: Windows 98 Final, AGP card: Real3D Starfighter 8MB AGP (Intel i740) Each test was ran five times and the average was used. RAM Speed score was taken using STREAM for DOS v2.0, with the resulting five scores averaged and converted into MB/s. STREAM measures 1MB as 1000000 bytes, so adjustments were made in the final score. EIDE speed was taken using HDTach 98 on an IBM Deskstar 14GB UDMA hard drive. The Intel i740 uses system memory for texture memory storage exclusively. Test was conducted using a 20.3MB texture setting

MAXIMUM PC VERDICT

Price $150
Company Soyotek
Phone 408.452.7696
URL www.soyo.com.tw

5

ADVERTISEMENT

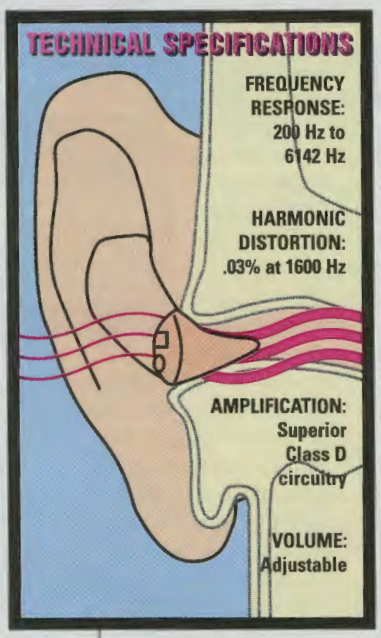
One scientist's vision revolutionizes the hearing industry, benefiting millions of people...

Crystal Ear® uses sophisticated electronics to provide affordable, cosmetically-pleasing and easy-to-use hearing amplification.

by Harold Sturman

One day a friend asked my wife Jill if I had a hearing aid. "He certainly does," replied Jill, "Me!" After hearing about a remarkable new product, Jill finally got up the nerve to ask me if I'd ever thought about getting a hearing aid. "No way," I said. "It would make me look 20 years older and cost a fortune." "No, no," she replied. "This is entirely different. It's not a hearing aid...it's Crystal Ear!"

No one will know. Jill was right. Crystal Ear *is* different—not the bulky, old-styled body-worn or over-the-ear aid, but an advanced personal sound system so small it's like contacts for your ears. And Crystal Ear is super-sensitive and powerful, too. You may hear sounds your ears have been missing for years. Crystal Ear will make speech louder, and the sound is pure and natural.



Innovative, breakthrough technology solves common problem...

Hearing loss, which typically begins prior to teenage years, progresses throughout one's lifetime. Many people suffering the type of loss Crystal Ear was designed for choose to leave the problem untreated. Crystal Ear is now available to help these people treat their hearing loss with a small and very affordable Class I in-the-canal hearing amplifier.

I couldn't believe how tiny it is. It is smaller than the tip of my little finger and it's almost invisible when worn. There are no wires, no behind-the-ear devices. Put it in your ear and its ready-to-wear mold fits comfortably. Since it's not too loud or too tight, you may even forget that you're wearing it! Use it at work or at play. And if your hearing problem is worse in certain situations, use Crystal Ear only when you need it.

A fraction of the price. Hearing loss is the world's number-one health problem, but in most cases it goes completely untreated. For many millions of people, hearing devices are way too expensive, and the retail middlemen want to keep it that way. What's more, treating hearing loss the old retail way can involve numerous office visits, expensive testing and adjustments to fit your ear. Thanks to Crystal Ear, the "sound solution" is now affordable and convenient. Many people with mild hearing loss, and millions more with just a little hearing dropoff, could be dramatically helped with Crystal Ear. Plus, its superior design is energy-efficient, so batteries can last months, not just weeks.

You'll feel years younger! Wear Crystal Ear indoors, outdoors, at home and at work. Crystal Ear arrives ready to use, complete with batteries, two different fitting sleeves, a cleaning brush and even a carrying case. Crystal Ear is a breakthrough advance in the hearing device field. It is made in the USA, using state-of-the-art micro-manufacturing techniques that cut costs dramatically—savings that we can pass on to you. The conventional companies, domestic and foreign, don't like that!

Don't be fooled by high prices. No hearing device, no matter how expensive, can eliminate background noise, despite claims by the manufacturers. Crystal Ear does not promise miracles—just an affordable, sound solution to many common hearing problems.

COMPARE CRYSTAL EAR AND SEE THE DIFFERENCE

	MOST IN-CANAL BRANDS	CRYSTAL EAR
Require fitting	Yes	No
Require hearing test	Yes	No
Battery life	160 hours	320 hours
Impact resistance	Average	Excellent
Telephone use	Yes	Yes
Retail price	$1,000-2,000	$299.85

DON'T TAKE OUR WORD FOR IT...

"My father spent over $5000 on another brand. I showed him my Crystal Ear, he tried it, and he decided it worked better than his brand, even though it was a small fraction of the cost!"

"It's so easy to put in and out of my ear... I just twist it. It's small and the tone matches my ear, so I can look in my mirror and not even see it in my ear. I'm very happy about that. In fact, no one has ever commented... I don't think anyone realizes."

—Satisfied Crystal Ear users
Results not typical

Risk-free. Try Crystal Ear and hear what you've been missing. It comes with a 90-day manufacturer's limited warranty as well as our risk-free home trial. If you're not satisfied, return it within 30 days for a full refund.

Crystal Ear®:
Three credit-card payments of $99.95 $19 S&H
If not purchasing a pair, please specify right or left ear.
Please mention promotional code **4016-13832.**

For fastest service, call toll-free 24 hours a day

800-992-2966

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comtrad industries
2820 Waterford Lake Dr., Suite 102
Midlothian, Virginia 23113

HP Pavilion 8290

Life in the slow lane

Despite some good components, this Pavilion proved sluggish in the stretch.

PLUSES
- 400MHz Pentium II
- DVD-ROM
- 12GB hard drive

MINUSES
- Sub-par performance
- Onboard video
- Lousy DVD performance
- No portable storage

The Pavilion 8290 is billed as the "machine that can take computer enthusiasts anywhere they want to go." If you're looking for a leisurely Sunday drive maybe. But if you're looking to go off-road and get mud on the tires, be forewarned: the Pavilion 8290 is like Kia's Sportage 4x4. You'll eventually get stuck in the mud without sufficient horsepower to pull yourself out.

With a 400MHz Pentium II processor, an Asus P2B98-XV motherboard, Intel's 440BX AGPset, and a honking huge 12GB hard drive, the 8290 seems primed to deliver. And with an Ensoniq AudioPCI soundcard, DVD-ROM drive, and AGP 2x graphics under the hood, it would appear that Hewlett-Packard is at least intent on giving you the cutting-edge technologies *Maximum PC* readers demand. But the benchmark results, prove the 8290's at the back of the pack in the 400MHz race.

So what makes this potential screamer a dreamer? Well, how about the "I'm soldered to the motherboard so there's no way in hell you can upgrade me" ATI 3D Rage Pro? You may save a few bucks using an OEM motherboard and going without an AGP slot, but those cost savings disappear the minute you want to upgrade. And since you can't, you'll be forced to (a) buy a new motherboard, or (b) shell out for a new system. Either way, you'll be out of pocket and out of luck.

And besides, the 3D Rage Pro is looking anemic these days. Although its TV-output is still stellar—both S-Video and analog outputs are included—this chip is in desperate need of a 3D overhaul. Polished OpenGL drivers would be a useful accessory too.

DVD is a nice touch, but the bundled Zoran/CompCore soft-DVD solution provides video quality on par with a 25-cent peep show. Banding, ghosting, and severe dithering are readily apparent, with the resulting out-of-sync chaos dropping frames and lurching more than a Dodge Viper on low-octane juice. Worse, whenever you hook up a TV, the screen resolution defaults to an off-kilter 848x480—fine for TV, but letter-boxed on the monitor.

The case is roomy inside, though, with seating available for three 5.25-inch and two 3.5-inch drive bays. Three PCI slots provide ample expansion, but we were disappointed that a removable storage option (such as a Zip drive) wasn't included.

UNDER THE HOOD

THE BRAINS

CPU	Intel 400MHz Pentium II Processor
L2 Cache	512K pipeline burst
RAM	64MB SDRAM (expandable to 384MB)
Motherboard	Asus P2B98-XV with Intel 440BX chipset
Drive Bays	Three 5.25-inch, two 3.5-inch
I/O Ports	Two USB, two serial, one parallel, one gameport, video-out, S-Video-out, two PS/2, audio in/out

DISPLAY

Video	ATI 3D Rage Pro AGP 2x (onboard) with 4MB SGRAM
Monitor	Hewlett Packard M70 17-inch with 0.28mm dot pitch
Res/Refresh	1280x1024@70Hz

STORAGE

Hard Drive	Quantum Bigfoot TX EIDE 12GB
DVD-ROM	Hitachi GD-2000 2X
Removable	None
Fax/Modem	Lucent Technologies 56Kbps fax/modem

SOUND

Soundcard	Ensoniq AudioPCI 1370 FM/wavetable synth
Speakers	Hewlett-Packard/Polk Audio satellite speakers

OTHER

Mouse, keyboard

THE BUNDLE

Microsoft Works | Money | Picture It! | Encarta 98 | Greetings Workshop | Quicken | Easy Photo | Operating Neptune | Ultimate Writing and Creativity Center | Reader Rabbit 2 | SimCity 2000 | Online Services | VirusScan | DVD sampler disc

BOOT 1:10 DOWN 0:25

Despite its 440BX pedigree, the 8290 doesn't burn rubber. In fact, it's the overall slowest 400MHz system we've seen to date. However, hardware MPEG decoding, a better monitor (the included 17-inch, 1280x1024 is a major letdown), and a beefed up video subsystem would turn the 8290 into a road warrior.

—Bryan Del Rizzo

MAXIMUM PC VERDICT

Price $2,399 without monitor; $2,898 with monitor
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6

REAL WORLD BENCHMARKING

CPU/MOTHERBOARD bootMark		191
WINDOWS APPS SYSmark 32		132
HARD DRIVE HD Tach	MB/sec	10.2
CD-ROM CD Tach98	K/sec	13.2
3D RENDERING Newtek Inspire3D	sec	559
DESKTOP PUBLISHING Adobe Photoshop 5.0	sec	133
DIRECT3D Forsaken Mark	fps	47.3
OPENGL Quake2 v3.15	fps	N/A

Pump Up The Volume The keyboard is a multimedia delight, with controls for CD action and system volume nicely positioned above the QWERTY keys.

EXPANSION NOTES

Isn't this ironic? There's lots of expansion space inside the case, but the only thing you can't upgrade is the onboard video—one of the few PC subsystems you'd definitely want to improve sometime in the future.

EXPANSION MAP

PCI	Free
PCI	Free
PCI	Sound Card
PCI/ISA	Free
ISA	Modem

IRQS

00	System timer	08	System clock
01	Keyboard	09	Soundcard
02	IRQ controller	10	Free
03	Free	11	USB Controller
04	COM1 port	12	PS2 Mouse
05	Legacy audio	13	Num data proc
06	Floppy port	14	IDE controller
07	LPT1	15	IDE controller

DMAS

01	ECP Printer Port	05	Free
02	Floppy controller	06	Free
03	Legacy Sound	07	Free
04	DMA controller		

Playing Chicken With the Sun A dedicated fan and heatsink keep the Pentium II inside mighty cool.

Uncouth, Uncool This is so sad... a spot on the motherboard for an AGP slot, but alas. The Rage Pro is soldered smack dab on the motherboard. The only way to get rid of it is to buy a whole new motherboard or PC.

Drive-In Express Check out all of the free space! The 8290's case design is clear and clutter free. Cables don't obstruct any of the free slots or drive bays, but...

Hatchback To Nowhere ...to gain access to those extra drive bays, you'll have to pop off this annoying front panel. Make it a sliding door, or get rid of it entirely.

Final Fantasy VII

Living in a materia world

The archetypal RPG on the Sony PlayStation has finally made the jump to the PC, bringing with it enhanced graphics that 32-bit console owners can only dream about.

FF VII combines pre-rendered, stylized backgrounds with realtime gouraud-shaded texture-mapped polygons. Action takes place in a skillful weave of *Alone In The Dark*-esque camera angles and an active, cinematic camera-tracking system for its quasi-turn-based combat system. At 640x480/16-bit and using all those cool visual niceties Direct3D PC users are accustomed to, such as bilinear filtering, alpha-blending, and more, *FF VII* roars. Unfortunately, the developers opted not to re-render the gorgeous 320x240 PlayStation background artwork, resulting in pixelation. Also, the FMV suffers from massive artifacting.

THE SPECS

3D CARD SUPPORT
- 3Dfx Voodo
- 3Dfx Voodoo²
- Rush
- Permedia
- ATI Rage Pro
- Intel i740

SOUND CARD
- DirectSound

MULTIPLAYER
- None

As monsters are summoned and weapons discharged, the camera tracks to capture the action. Framerates on a pimped-out machine remain smooth and fast. But check carefully which D3D cards are supported, as Riva 128 owners are crying foul over *FF VII*'s lack of hardware support.

Prepare to invest major time in *FF VII*. This four-CD brute contains much adventuring—while the main plot is linear, there are side quests aplenty (mainly for extra party members or super-secret weaponry and magic). The extraordinary combat system verges on the extreme, but it's the only way to pump up those characters and get them strong enough for the final confrontation.

My, what a big sword you have! Final Fantasy VII's pseudo realtime combat takes some getting used to, but the spell effects are well worth it.

Some folks may be turned off by the gameplay mechanics and big-headed anime character design—others will be offended by the game's adult situations and blatant stereotyping. But RPG lunatics lusting for a long adventure until the next *Ultima*, *Wizardry*, or *Fallout* should look no further than *Final Fantasy VII*—the cure for the common RPG.

—Andrew Sanchez

MAXIMUM PC VERDICT

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8

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TERMINATOR

▶ Tech Terms Revealed

A

Accelerated Graphics Port AGP is 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.

ADC Analog Digital Converter. See DAC.

ADSL Asymmetric Digital Subscriber Line. A protocol for high-bandwidth data transmission. Uses regular, old copper telephone lines to support downstream throughput from 1.5 to 9Mbps.

AGP see Accelerated Graphics Port

AGPset Any core logic chipset that supports the AGP bus. See core-logic chipset.

AI see Artificial Intelligence

alpha-blend The ability to give a pixel a value that will render it solid, invisible, or partially transparent. The process is often used in games to depict special effects, such as explosions and weapon discharge. When mapped onto polygons, alpha-blending can simulate semi-transparent objects, such as water and glass.

algorithmic procedure texturing A formulaic method of rendering imagery capable of generating potentially unlimited detail.

Amiga The first true multimedia computer. Anyone who is cool either worked on an Amiga, owned an Amiga, or claims to have been on the periphery of the Amiga's design.

aperture grille A CRT technology that fosters a bright display (compared to the competing shadow mask technology). The aperture grille itself is a collection of fine metal strips that stretch vertically from the top of the screen to the bottom. The monitor's electron beam is shot through the grille, which positions the beam so that it correctly excites the red, green, and blue phosphor dots that ultimately comprise the picture you see on the screen. Because an aperture grille allows more electrons to pass through than a shadow mask, it tends to foster a more brilliant image. Currently, Sony and Mitsubishi manufacture all the aperture-grille CRTs used by the world's many monitor companies.

API see Application Program Interface

Application Program Interface A set of programming protocols. Instead of a programmer creating custom codes to talk to an operating system directly, he or she can write an application to an API specification, and the instructions will be passed on to the operating sytem.

Application Specific Integrated Circuit A silicon chip hard-coded to run a specific application.

artifact Graphical flaw caused by the shortcomings of a compression technology. Often manifested as blotchiness in what should be a solid color.

Artificial Intelligence The "brains" of a computer-controlled game character. AI determines how the computer reacts to human decisions, and in theory should "learn" human strategy as the game progresses.

ASIC pronounced "a-sick." See Application Specific Integrated Circuit.

ATAPI ATA Packet Interface. Defines a set of commands supported through the ATA-2 interface for peripherals other than hard drives, such as CD-ROM, DVD-ROM, and tape drives.

A3D see Aureal3D

ATX A motherboard formfactor that's smaller than AT, it's a standard configuration definition for most modern full-size desktop and tower PCs. Subsets of this include NLX, LPX, and MicroATX. There are numerous differences between the older Baby AT formfactor and ATX, including relocation of the CPU to an area closer to the power supply fan and concentration of I/O ports in one rectangular cluster. How do you know which one you have? Generally, an ATX-type machine will turn itself off after selecting shut down in Windows 95 or NT.

Aureal3D A proprietary API for handling 3D positional sounds and Doppler effects. Using algorithms developed for NASA, A3D is able to simulate 3D positional sounds on two speakers. A3D will support four or more speakers, but is optimized for two.

B

banding Extraneous lines in a printed page or displayed image. On a monitor, banding occurs when the color depth of the video signal isn't rich enough to display a continuous color gradient.

bezier path In drawing applications, a curved line defined by at least three adjustable points. The shape of the curve can be altered by tweaking the handles extending from each point.

bilinear filtering Bilinear interpolation. An algorithm that can be used to apply textures to 3D objects. An example would be to apply a texture of bricks over a sphere, making it look as if it were composed of bricks.

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.

blue screen of death Slang to describe the Fatal Exception Error screen that appears after a full-blown system crash.

browser-centric world A futuristic paradigm in which everyone accesses shared applications and information through browser software.

brushes 2D sprite-based elements integrated with transparent margins in a 3D engine.

bump mapping A technique for simulating textured surfaces by varying the way in which objects reflect light.

bus A data channel connecting two or more parts of a computer. The expansion bus, for example, is the conduit through which PCI cards share data with the CPU and system memory.

bus-mastering drivers A feature that enables a controller connected to the bus to communicate directly with other devices on the bus without going through the CPU. Most modern bus architectures, including PCI, support bus mastering because it improves performance.

bytecode Java programs are compiled to produce bytecode. Because Java is designed to be machine agnostic, the bytecode is again compiled on the machine that executes it by a Just-In-Time compiler.

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

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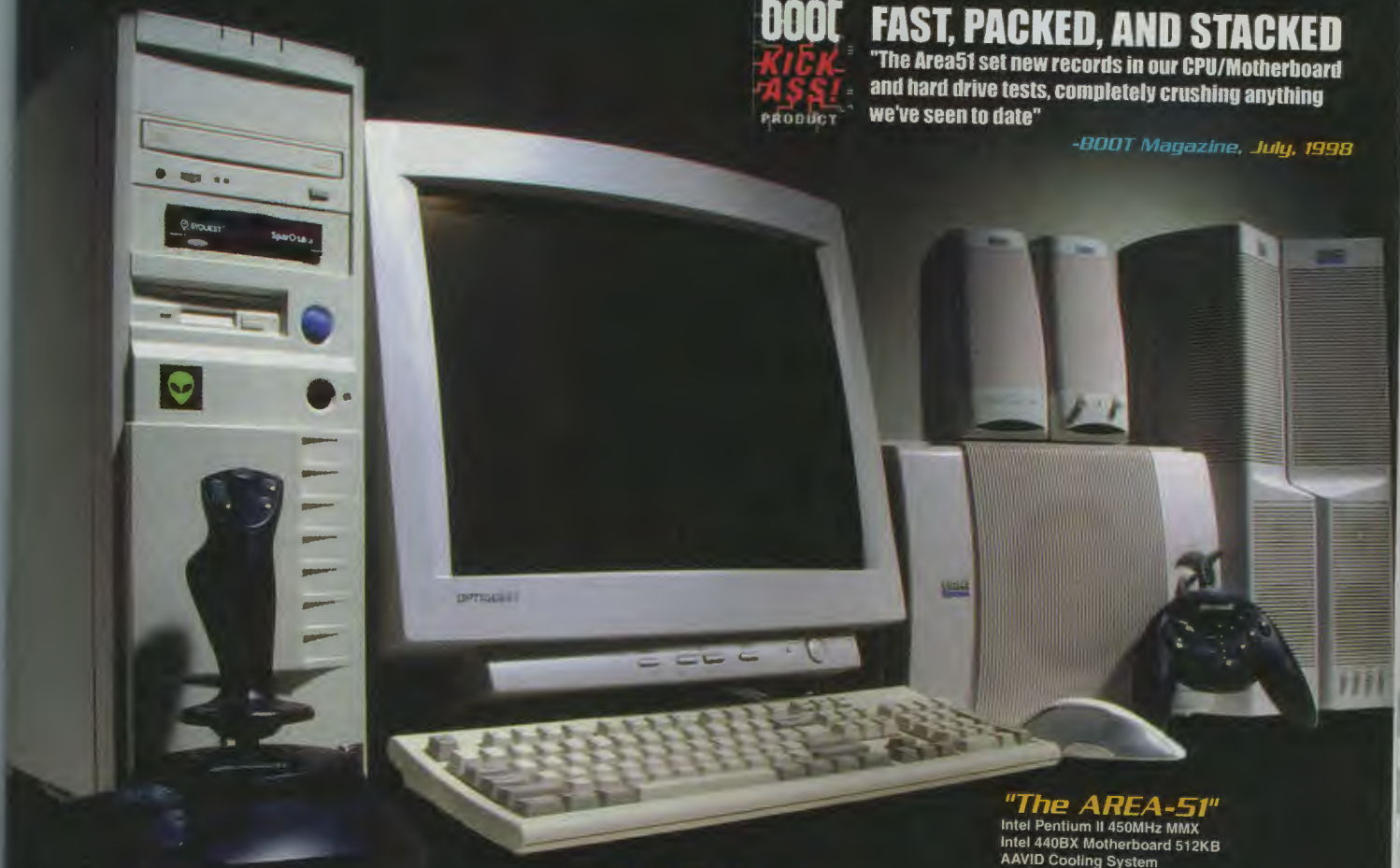

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THE SAINT

MICROSOFT DEFECTOR TELLS ALL

ALEX ST. JOHN was the architect of DirectX while an evangelist at Microsoft. Since leaving the empire, he has remained a player, brokering many deals in the industry.

Quake: Windows' Biggest Threat

THE ULTIMATE 3D GAME HAS THE BEST SHOT AT FRAGGIN' MICROSOFT

When I started working as Microsoft's game evangelist, I paid my first visit to id Software to meet a guy named John Carmack. My mission: learn what Windows needed to become a great gaming OS.

Afterward, Bill Gates sent me e-mail asking if I thought id would ever become a competitive threat to Microsoft, then he asked if we should buy id Software.

I wish I still had the mail I sent Bill, but I remember saying something to the effect that the potential for virtual worlds to become platforms was tremendous in the game industry, but that it wasn't clear to me that id had fully realized that yet.

I said it would take time for the then-DOS-bound community of game developers to wake up and migrate from making dedicated single-player disposable applications, to persistent multiplayer game universes... and then to develop the business model to turn them into platforms such as Windows.

I think I used that mail as an opportunity to point out that simply making better multimedia drivers to migrate DOS game developers to Windows would not provide Microsoft any security or significant advantage when the developers finally started making successful game platforms.

Today, I think id may actually be aggressively discovering the power of being a platform. John Carmack is the first and only person I've ever met in the game industry whom I believe might actually have the potential to grow up to be the next Bill Gates.

To date, Microsoft is the only company that has actually mastered platform power and refined it to an art. But Microsoft is blind to the game industry, and id's technology is increasingly showing the hallmarks of a developing platform.

A platform is more than a set of tools that a community of applications are dependent on. There is a spark of magic in the idea behind a platform, and the process by which it is created, adopted, and evolved.

Sun, Novell, IBM, Lotus, and Adobe have all tried to contrive a platform. Adobe succeeded with PostScript and then lost its leverage. Netscape had one, but didn't know how to use it, and so succumbed to Microsoft, as well. Java, of course, is a rapidly decaying attempt to create another one.

Ah, but Quake.... id is the best at something everyone wants now, and something everyone will soon need. Quake is the best 3D solution for the Internet. It has a huge community of content developers, and it's being used for content and applications for which it was never intended. id has carefully modularized the engine to support extensibility and component replacement.

John has an IQ lock on the technology that makes that kind of realtime world possible. Sure, other people make pretty good 3D shooters, but id has created a network infrastructure, it has OEMs who license the technology, and of course everyone buys the client software. John is making a completely new kind of OS for the PC, one based on the delivery of 3D content via the Internet. In many less-than-obvious ways, Quake II is already well beyond any other 3D engine currently on the market. The game he puts on his engine, Quake III, for example, is just his best content offering, just as Office is Microsoft's best content offering for its own platform.

John has also started flexing serious platform muscle.

He's telling Microsoft where to stick its 3D strategy, which by itself means nothing. But he's also using his emerging platform power to shove Microsoft around for a change.

As an OS, Quake is already powerful enough to demand support for its own driver model from the entire 3D hardware community. He's also told Apple that he'll only port Quake to Rhapsody. It reminds me of the first moves Bill made to subjugate IBM... right up to the day he told them he would decide what OS they'd use from then on.

I'm sure Carmack wouldn't necessarily find the characterization of being a budding Gates complimentary, but in my opinion, he's the only kind of competitor that has a chance against the Empire.

John Carmack is the first and only person I've ever met in the game industry I believe might actually have the potential to grow up to be the next Bill Gates.

There are still many hurdles id has to leap to get there, and it isn't completely clear that John wants to take them. Supporting thousands of screaming developers and OEMs just doesn't seem like John's bag. But it's a necessary step for an evolving platform. If id doesn't take it, somebody else eventually will. I predict that very shortly a number of 3D engines designed to be platforms will appear in the market, and id may have a different kind of competition cut out for it. ✹

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