

Simpler Choices in Graphics Hardware for Today's AutoCAD Professionals

By Alex Herrera

There was a time when the AutoCAD professional had but two choices in graphics acceleration hardware, neither particularly appealing. Opt for elaborate hardware available exclusively in expensive, proprietary workstations, budget be damned. Or mind the dollars and outfit a PC with whatever graphics solution the industry was pushing at the time — sacrificing reliability, compatibility, and performance.

Fortunately that's all changed and none too soon for those making a living running AutoCAD. Today's buyer doesn't have to break the bank to take advantage of graphics hardware built, tuned, and tested for the world's most popular CAD application.

What's been the catalyst for this change? It's not simply the advancements in system architecture and semiconductor manufacturing processes or the ability in each generation to cram more transistors on a chip produced for fewer dollars. Have these been important factors? Sure. But it's been more than that.

It's been the ever-more precise refinement in hardware designed to meet the unique and evolving demands of AutoCAD that's pushed up render performance and quality. And at the same time, the explosion in the sheer volume of 3D hardware has allowed the industry to drive prices down much faster and more dramatically than denser manufacturing processes could alone.

Combine the two and today's hardware graphics products offer the best of both worlds: the top-end performance and reliability professionals demand, delivered at prices consumers expect.

3D for Gaming and 3D for AutoCAD: Different Applications Demand Different Graphics Solutions

The progress of 3D gaming has been astonishing. In terms of raw performance and visual effects today's games are on the cutting-edge, pushing innovation in hardware and software to new levels. And like professionals, hard-core gamers have shown an insatiable appetite for the fastest, most feature-rich graphics hardware.

But has the tremendous growth in 3D game technology led to a universal hardware solution that satisfies both the gamer and the CAD pro? On the contrary. Despite the fact that a single foundation of high-performance 3D technology underlies both spaces, one-size-fits-all 3D graphics doesn't make sense for today's diverse applications and likely never will.

A game isn't CAD, and vice versa. So the ideal set of features and the optimum balance of performance for the CAD professional will be different than that of the gamer. Technologies have converged, but how the technology gets employed hasn't. For professional-grade 3D hardware, it's all about tuning the pipeline and balancing the workload for AutoCAD, not the latest version of *Halo*.

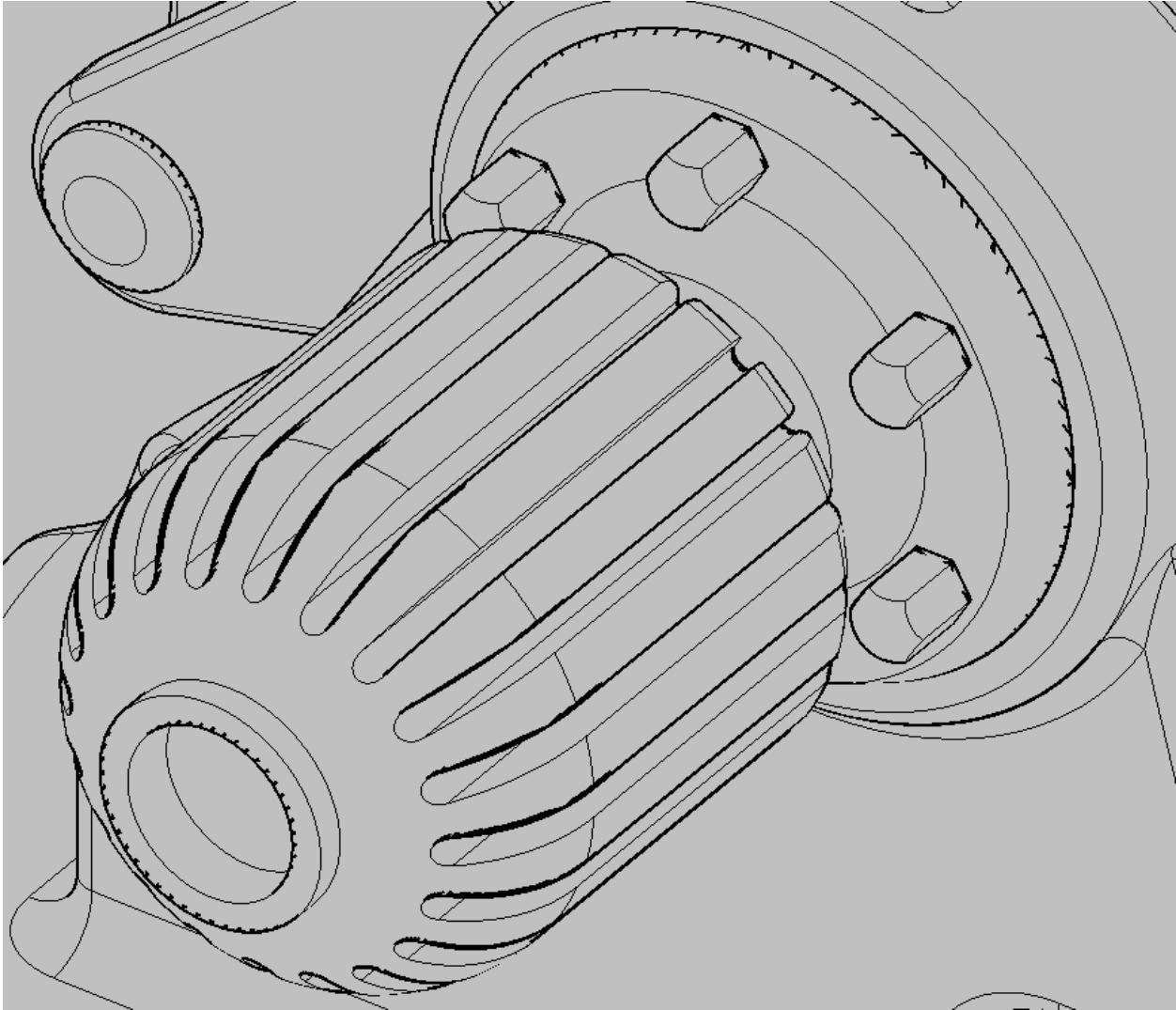
Shaping today's professional-caliber graphics products means focusing on 3D hardware features that may be of no consequence to the latest must-have game, but that can make or break performance when running AutoCAD. It means tuning the pipeline to streamline operation for the rendering types most commonly employed by AutoCAD, resulting in optimum performance. And perhaps most importantly, it means never compromising reliability.

Hardware Dedicated for Latest AutoCAD 3D Features

Just as graphics hardware has evolved, so has AutoCAD. With its 2007, 2008 and 2009 versions, Autodesk has introduced a host of CAD-tailored 3D features, placing substantially higher demands on a system's graphics capabilities. A look under the hood of today's professional-class graphics cards reveals hardware resources specifically dedicated to the types of graphics rendering and display that today's AutoCAD environments stress.

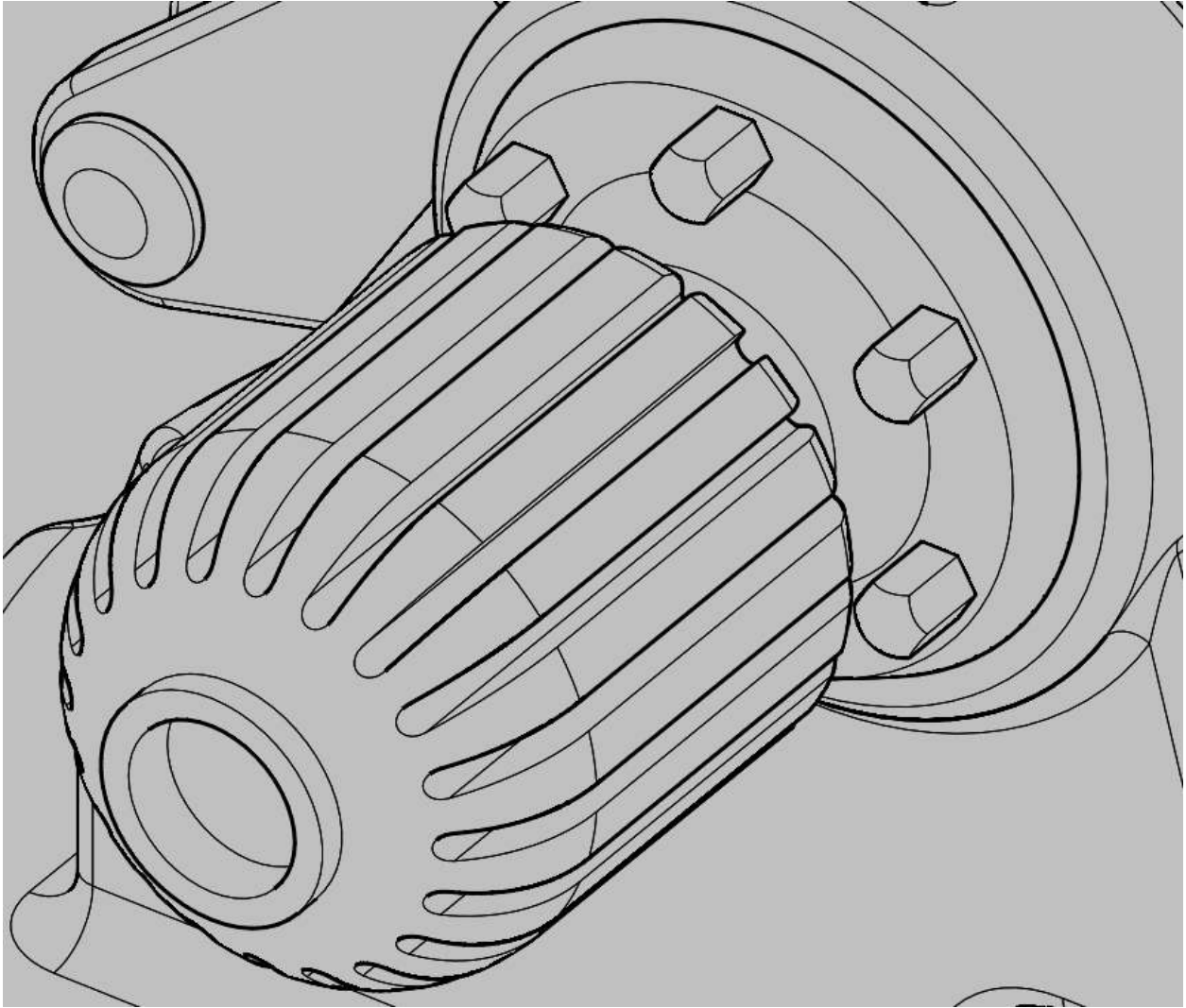
Smooth Lines

Games don't paint many lines. So when building a graphics card optimized for games, there's little reason to be concerned with how fast or how clearly lines get drawn. Consequently, while most any card can render a generic line, it's not going to produce the smooth, high-quality lines that AutoCAD demands. And that leads to one of two choices: sacrifice line quality for the sake of performance or fall back to software rendering and live with the inevitable drop in frame rate.



AutoCAD rendering with smooth lines turned off.

By contrast, professional-class cards like NVIDIA Quadro FX boards, integrate a fast hardware engine specifically designed to draw AutoCAD-style smooth lines. The end result: aesthetic lines without the performance penalty.



AutoCAD smooth lines, rendered on a professional Quadro FX graphics card.

Fast, High-Quality Gooch Shading

Game developers aim for visuals that impress on the player the distinctive look and feel of whatever 3D world the artists envisioned. But that same look and feel won't necessarily carry over to CAD work, where images are rendered with a very different intent. A 3D shader built to depict facial features or a dimly-lit back alley isn't going to be the one that best represents the detail in an automotive brake assembly or renders an orthographic view of the new town hall.

With different visual goals in mind, CAD applications naturally employ different shaders than a game might. AutoCAD's Conceptual style, for example, employs the Gooch shader, created specifically for rendering technical illustrations. So while gaming hardware has little reason to run a fast, high-quality Gooch shader, cards expressly built to run AutoCAD do. NVIDIA incorporates a performance-tuned-and-tested Gooch shader into its entire Quadro FX line.

It's Not Just About the Hardware: Fine-tuning Drivers for AutoCAD is Essential

Often overlooked in the evaluation of graphics products is the underlying software that drives all this cutting-edge hardware. Stuffing more compute resources onto each successive generation of GPU is critical, but without an efficient driver the hardware's raw horsepower matters little.

Slow code paths, excessive overhead per API call, ineffective communication between driver and card — such potential pitfalls abound. A driver architecture that is poorly suited or improperly tuned for the target application can bottleneck performance well below the hardware's theoretical capacity, leaving the user wondering why he ever spent hard-earned dollars on a new card in the first place.

What makes an optimally designed driver for AutoCAD is inherently different than what makes an optimally designed driver for the typical 3D game. Quadro FX drivers have been tuned to provide faster code paths for the operations common to AutoCAD. Fewer instructions, fewer branches, and bigger batches of data per API call mean less overhead. And less overhead means faster performance, in some cases dramatically so.

Combine that fast-tracked driver code with hardware dedicated for the features AutoCAD stresses most and professional cards can deliver performance a consumer-class card simply can't match. Benchmarking of NVIDIA Quadro FX solutions have shown a 5X performance boost in rendering AutoCAD's Conceptual visual style and up to 10X for 3D Hidden.

What's that all mean for productivity? It means manipulating visually-rich models with a snappy, real-time response. And it means fewer encounters with AutoCAD's *adaptive degradation*, that awkward fallback to a more primitive model view, sacrificing detail in order to sustain a reasonable frame rate. Run AutoCAD on a professional-caliber card and expect to view more complex models and smoother walk-throughs in full-fidelity, with all the intended fine details intact.

Reliability Can't Ever Take a Back Seat

Gamers want one thing above all else: the most frames per second possible — and cards built for gamers will go to great lengths to get it for them. Does a gamer want to push clock rates to the absolute edge to scrape up one more frame per second? Absolutely, even if it means sacrificing reliability to get it.

But for the CAD professional measured on meeting deadlines, uptime isn't a negotiable commodity. In contrast to consumer cards, operating parameters for professional hardware are set with performance in mind, but with rock-solid reliability the goal that cannot be compromised. Performance, yes. Overclocking, absolutely not.

With the aim of delivering the fastest and most dependable graphics hardware, vendors like NVIDIA take on the time-consuming task of certifying their hardware products like Quadro FX on the most demanding, widely used professional applications, including AutoCAD. NVIDIA quality assurance engineers spend 2,000 man-hours per year

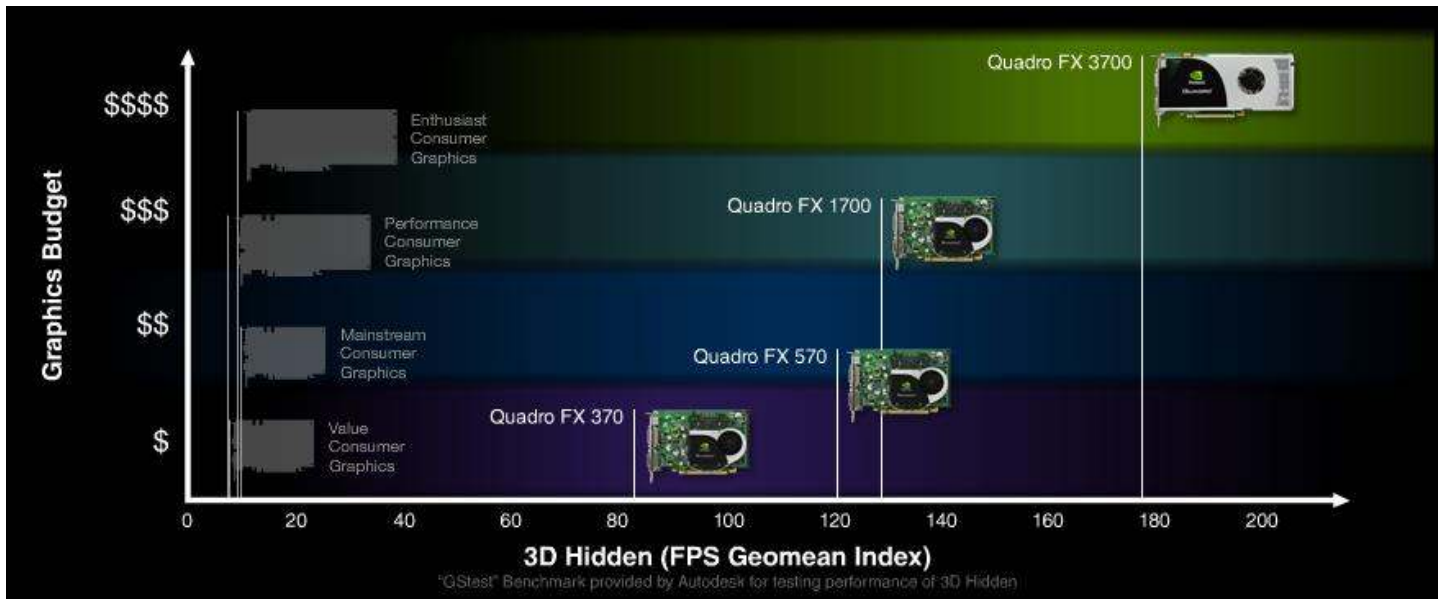
working with Autodesk to ensure compatibility, speed performance-critical paths, and thoroughly test Quadro FX solutions for AutoCAD.

What's the end result? Confidence that the card's not going to fail when the user can least afford it — not the hardware, not the driver. While this is sensible and cost-effective for a Fortune 500 installation with a dedicated IT support staff, it is absolutely critical for a small office relying on do-it-yourself tech support.

The Best of All Worlds: Specialized Hardware for AutoCAD Demands, Delivered at Consumer-Level Prices

Rather than being a threat, the emergence of high-performance PC gaming has been a boon to professional graphics hardware. While consumer-class cards can't optimally serve the unique demands of the AutoCAD professional, the sheer growth in 3D volume across the markets have driven prices down for all types of products, including — and perhaps especially — professional cards.

At street prices extending down to around \$150 (witness NVIDIA's recent Quadro FX 370), today's professional cards ship at prices comparable to the latest consumer offerings, yet they deliver AutoCAD performance well beyond what the gamer's card can offer.



AutoCAD performance on professional Quadro FX solutions is far superior to that of comparably priced consumer-class hardware.



NVIDIA Quadro FX 370: professional-caliber graphics in a ~\$150 package.

Autodesk Raises the Minimum Bar on Graphics

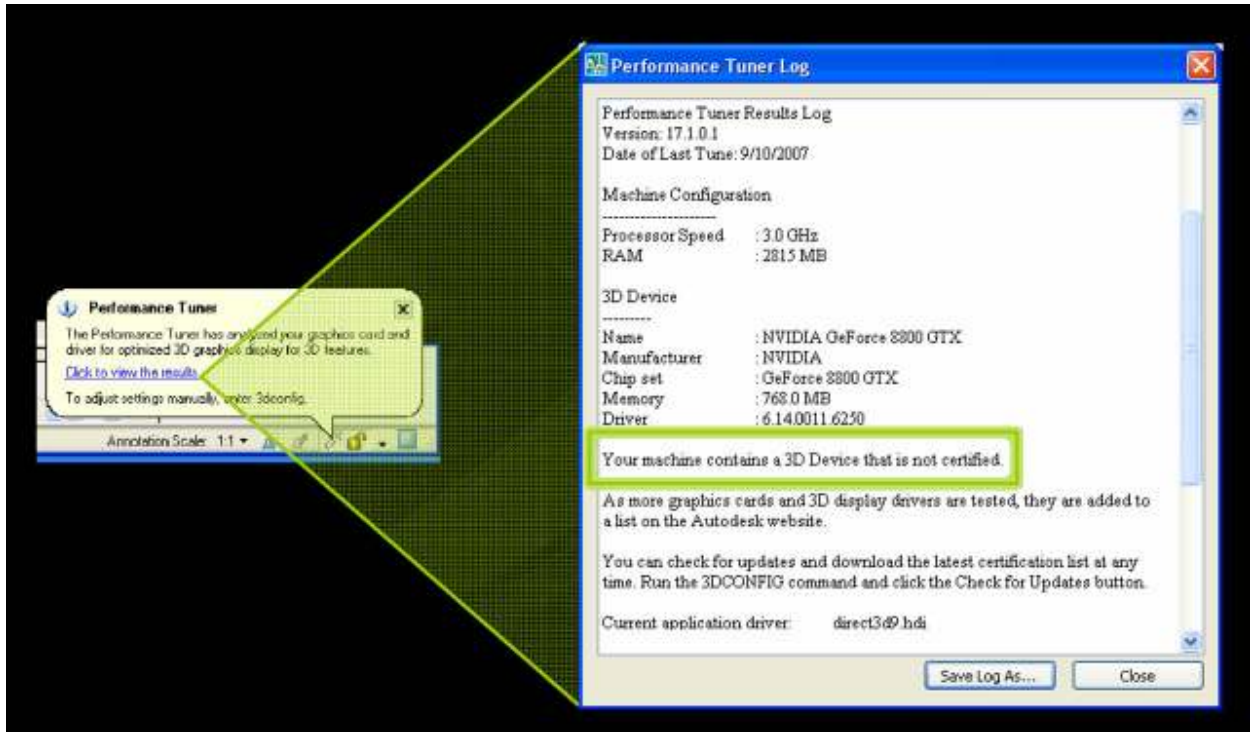
Autodesk and other CAD independent software vendors (ISVs) consistently identify fewer support issues (per user) for tested, certified professional cards than their consumer-focused counterparts. Now with certified cards available at prices accessible to all, Autodesk has taken action, raising its base-level hardware requirements for AutoCAD. No longer is just any card or motherboard graphics solution with a DirectX or OpenGL driver blessed with support.

Now for installations running 3D on AutoCAD 2007 (or running any package on Vista), the company's minimum system requirements explicitly specify "workstation-class graphics cards with 128 MB or greater." Autodesk's motivation and intent are clear from the company's product literature:

Autodesk-certified graphics hardware is better suited for the 3D display features of AutoCAD 2007 and AutoCAD 2008. Non-certified graphics hardware may not support these new features or may cause problems during use.

While some gaming based graphics hardware will work with AutoCAD's 3D display features, they are neither optimized for optimal performance nor are they supported by the graphics hardware vendor for CAD use. If you encounter problems, Autodesk will not be able to obtain support from the graphics hardware vendor to fix them.

If AutoCAD detects a non-certified card, it will notify the user and turn off the default hardware acceleration. The application may still run, but it's then left to the user to determine what the card can and can't handle, manually enable hardware acceleration as appropriate, and accept any quality and performance tradeoffs that result.



AutoCAD checks on whether or not the graphics card is certified.

By contrast, should it detect the presence of a certified card — like any in the Quadro FX line — AutoCAD will automatically enable hardware acceleration for all the essential features: fast smooth lines, Gooch shaders, and everything else AutoCAD needs to run at optimum speed. The user gets full performance and image quality without having to hunt down the right dialog box to manually enable acceleration.

The Work is as Demanding as Ever for AutoCAD Pros, but Choosing Graphics Hardware is Now Much Simpler

Times have changed. It used to be that the demands of your work told you to buy a workstation-class card, but your wallet told you something else. Not any more.

The proliferation of 3D technology across a range of platforms has helped push professional 3D hardware to new levels. With prices on par with consumer-class hardware, professional cards deliver superior performance, quality, and reliability for

AutoCAD. And now ISVs like Autodesk are beginning to specify them as mandatory equipment.

Competitive pricing, unmatched performance, and the reliability and peace of mind that comes with Autodesk certification ... why should an AutoCAD pro settle for less?

Alex Herrera has more than 20 years of engineering, marketing, and management experience in the semiconductor industry. He is an independent consultant focusing on high-performance graphics and workstations. Author of frequent articles covering both the business and technology of graphics, Alex is currently responsible for the Workstation Report series, published by Jon Peddie Research. He continues to advise companies competing in fields related to high-performance graphics and client-centric computing.