



AMD FirePro™ V7900 / AMD FirePro™ V5900

PROFESSIONAL GRAPHICS REVIEWER'S GUIDE

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Welcome

The AMD FirePro™ V7900 and AMD FirePro™ V5900 are the latest high-end and mid-range professional graphics products from AMD, targeted at demanding professionals, particularly those in the CAD, CAE and DCC markets.

With leading performance for applications used in these target markets, and award-winning AMD Eyefinity technology, these new AMD FirePro professional graphics products represent another milestone in increasing user productivity for the increasingly complex workflows that are seen in workstation usage.

This guide will take the reader through all the important facets of the AMD FirePro V7900 and AMD FirePro V5900 cards ranging from core specifications through to advanced features new to the cards and the 'Cayman GL' GPU that powers them. Key performance data is also provided.

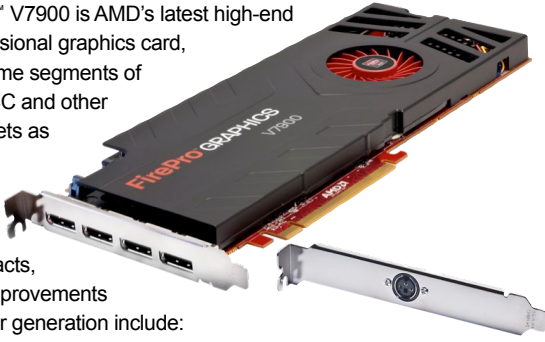
A Branding Transition: ATI FirePro to AMD FirePro

While these products are the latest in the 'FirePro' family, one of the first visible differences from earlier-generation cards is the adoption of the AMD brand, as the older ATI brand is retired. While the name may have changed slightly, the card comes from the same team that brought previous award-winning ATI FirePro products to market, and these professional graphics products continue to offer exceptional performance, reliability, distinctiveness and value.

Please ensure that all references to these new products correctly identify them as AMD FirePro V7900 and AMD FirePro V5900 professional graphics. For complete details on the new branding, please refer to the *AMD FirePro V7900_V5900 Branding Product Advisory_May_10_2011.pdf*.

Introduction to the AMD FirePro™ V7900

The AMD FirePro™ V7900 is AMD's latest high-end workstation professional graphics card, addressing the same segments of the CAD/CAE, DCC and other professional markets as the ATI FirePro V7800 launched in 2010.



Some of the key facts, differences and improvements relative to the older generation include:

- A 'Cayman GL' GPU with 1280 Stream Processors, and 2 GB GDDR5 memory.
- A single-slot form factor, with a power consumption of under 150 Watts
- Four DisplayPort connectors supporting DisplayPort 1.2 – a first in professional graphics.
- AMD technologies including PowerTune and GeometryBoost that deliver significant improvements in performance over previous generation graphics adapters.

Introduction to the AMD FirePro™ V5900

The AMD FirePro V5900 is a mid-range workstation professional graphics card, addressing the same segments of the CAD/CAE, DCC and other professional markets as its predecessor the ATI FirePro V5800 launched in 2010.



Some of the key facts, differences and improvements relative to the older generation include:

- A 'Cayman GL' GPU with 512 Stream Processors, and 2 GB GDDR5 memory. A 2 GB framebuffer represents a doubling of the amount of memory in this range of accelerator.
- A single-slot form factor, with a power consumption of under 75 Watts, requiring no extra power provision.
- AMD Eyefinity technology with two DisplayPort connectors supporting DisplayPort 1.2, and one dual-link DVI connector.
- AMD technologies including PowerTune and GeometryBoost that deliver significant improvements in performance over previous generation graphics adapters.

Key Technologies

AMD Eyefinity technology and new Workflows

AMD Eyefinity technology, introduced to professional GPUs with the ATI FirePro 'Vx800' series (ATI FirePro V9800, ATI FirePro V8800, etc) in 2010, represented a revolution in terms of GPU capabilities, delivering three, four or six display outputs from the entire range of AMD professional graphics products (with the exception of the ATI FirePro V3800 which maintained two outputs to maintain a half-height form factor).



The ability to drive additional displays (beyond the traditional two of older and competing GPUs) is far more important than simple numerical comparison ('three is better than two'): the workflows of today's professionals are unquestionably becoming more complex, particularly in the CAD/engineering world, where workflows have migrated from being simply about parts design and increasingly about entire assemblies, including various forms of analysis (mechanical, stress, fluid), and even into full product lifecycle management (PLM). In the digital content creation world, complex production pipelines have been the norm for a number of years, but the tighter integration between applications makes the workflows more seamless.

The increasingly workflow-driven nature of professionals' work has been difficult to miss; nothing exemplifies this new reality like the recognition of industry giants such as Adobe® and Autodesk®, who have moved toward providing their applications in suites. Adobe is presently in their fifth generation of suites with the recently released Adobe Creative Suite 5.5, and Autodesk announced their shift to a similar model of suites for their applications, announcing a total of seven different workflow-based suites for users of their tools from DCC to engineering.

AMD Eyefinity technology is exceptionally well placed to meet the needs of users with these new workflows, allowing them to display the different applications (and the dense user interfaces they present). The AMD FirePro V5900 offers three display outputs, enabling users to work without the burden of continuously having to switch between applications, and the AMD FirePro V7900 offers four outputs for the most highly complex workflows, and for other advanced multi-display scenarios such as those in event and digital signage.

AMD PowerTune technology

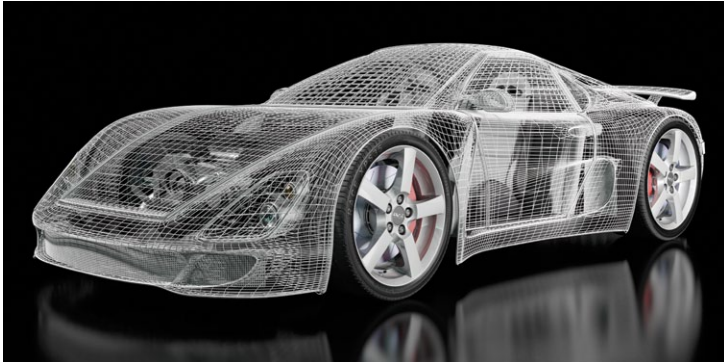
AMD PowerTune technology helps deliver higher performance that is optimized to the thermal limits of the GPU by dynamically adjusting the clock in real time based on an internally calculated GPU power usage. AMD PowerTune technology is very different from existing and previous methods; rather than setting highest state GPU clock speeds based on a worst case TDP approach that can compromise performance in a majority of applications, AMD PowerTune technology can dynamically adjust the performance profile in real time to fit within the TDP envelope.

An important point to note about PowerTune on the AMD FirePro™ V7900 and V5900 professional graphics cards is that the calibration information (that sets clocks based on power draw in the GPU) has been defined with today's workstation applications in mind. Generally speaking, these applications have a very different GPU use profile from consumer GPUs. For example, they typically do a great deal of geometry processing, and significantly less pixel shading and texturing. When compared to previous generation workstation graphics accelerators, increases in performance on consumer applications and benchmarks are more modest than for professional applications.

For more information on AMD PowerTune technology for professionals, see [AMD_PowerTune_whitepaper.pdf](#).

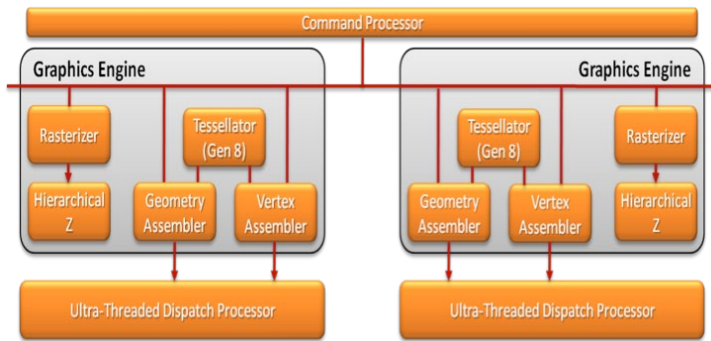


AMD GeometryBoost technology



The AMD FirePro™ V7900 and V5900 professional graphics cards implement the new AMD GeometryBoost technology and so are designed to process geometry data at up to twice the rate of previous-generation GPUs. The implementation of this capability is driven by the need for professional graphics cards to process complex models and the emerging use of GPU tessellation (which creates or amplifies geometry within the GPU). AMD GeometryBoost has been accomplished by putting in place a dual graphics engine architecture which allows graphics workloads to be divided and dispatched for processing in a highly efficient manner.

The dual graphics engine is portrayed in the diagram below, and shows the presence of geometry and vertex assemblers in each engine (also linked to the tessellator units), that effectively instantiate the GeometryBoost feature.



AMD HD3D Pro technology

Stereo 3D is a technique highly valued in a number of professional use cases, where the additional information conveyed by stereo viewing enhances productivity and/or enables capabilities that are not possible otherwise. Some examples include computer aided design, digital content creation, data visualization and virtual reality applications.

AMD has supported Stereo 3D functionality in the ATI FirePro™ and ATI FireGL™ product lines for a number of years. AMD HD3D Pro technology encompasses this existing support and is adding the support for the new HDMI and DisplayPort Stereo 3D standards, as well as the capability to drive multiple Stereo 3D displays synchronized across multiple GPUs or even across multiple computer systems.

For a comprehensive overview of HD3D Pro, the reader is strongly encouraged to refer to AMD's whitepaper on the subject: *AMD HD3D Pro Technology: Stereoscopic 3D For Professionals*.

OpenCL™ and AMD App Acceleration

OpenCL™ is an open, multi-platform development platform for heterogeneous architectures, and is key to unlocking the processing power of the GPU for applications that go beyond strictly graphics requirements.

AMD has been at the forefront of both the evolution of this API within The Khronos Group (the standards body that manages the OpenCL specification and

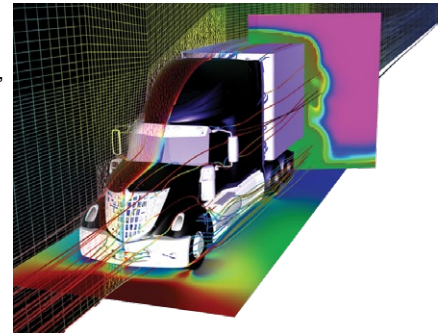


Image courtesy of Darin McKinnis, Enight Corporation.

certification of compliant products that implement it), and in delivering a steady cadence of robust software development kits (SDKs) to the developer community.

OpenCL has broad applicability in many areas of computing experiences, but in the world of graphics professionals, it is already starting to gain real traction as software vendors begin to leverage GPU computing in their applications. We can expect to see OpenCL-based analysis in CAD/CAE applications (e.g., show the user where objects intersect, simulate the dynamics of an assembly, view stress on components), and we can expect to see applicability in the arena of digital content creation where more realistic physics, visual effects and image processing techniques can be implemented on the GPU and made to run significantly faster than in the past.

DisplayPort 1.2

In early 2010, the DisplayPort 1.2 specification was ratified in VESA. This new revision of the display interface standard adds support for new features including high bit-rate audio, even higher bandwidth, and multi-streaming capabilities.

Just as AMD was the first to integrate DisplayPort technology into professional GPUs with the ATI FirePro™ 2260, the AMD FirePro V7900 and V5900 integrate support for the new revision 1.2 of the standard. The table below is a simplified comparison of display interface capabilities integrated into these workstation professional graphics cards.



	DisplayPort 1.2	DisplayPort 1.1a	SL-DVI	DL-DVI	HDMI 1.4a
Bandwidth	21.6 Gbps	10.8 Gbps	4.95Gbps	9.9 Gbps	6.75 Gbps
Video Data Rate	17.28 Gbps	8.64 Gbps	3.96 Gbps	7.92 Gbps	5.4 Gbps
Maximum Resolution Support @ 24bpp 60Hz	4096 x 2160	2560 x 2048	1920 x 1200	2560 x 1600	1920 x 1200
Audio Support	Yes	Yes	No	No	Yes
Embedded Application Support	Yes	Yes	No	No	No
In-band Stereo 3D Signaling	Yes	Yes	No	No	Yes
Multi-stream Support	Yes	No	No	No	No

Table 1: Display interface capabilities of the AMD FirePro V7900 and V5900 professional graphics cards

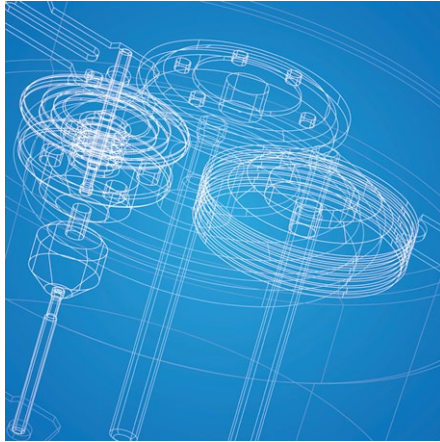
DisplayPort 1.2 supports up to twice the bandwidth of DisplayPort 1.1a. High Bit-rate 2 (HBR2) provides up to 5.4 Gbps/lane of bandwidth, or up to 21.6 Gbps in a full four-lane configuration. This lends itself very well to many applications that require ultra-high bandwidth.

New Anti-Aliasing technologies

Enhanced Quality Anti-Aliasing (EQAA)

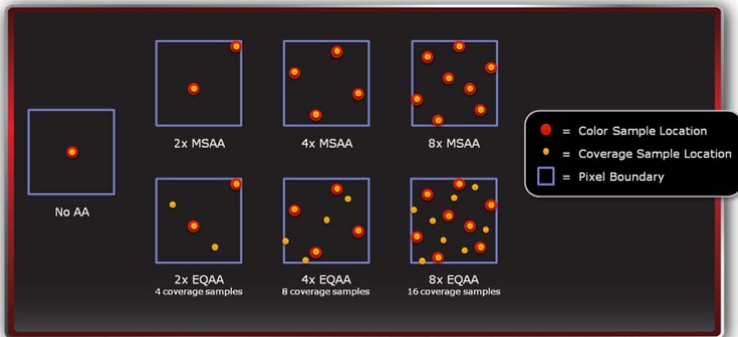
EQAA is a new anti-aliasing option available on the latest series of AMD FirePro™ professional graphics cards. This technique offers advanced smoothing of aliased edges without requiring additional video memory, and with a minimal performance cost.

It offers enhanced quality over standard Multi-Sample Anti-Aliasing (MSAA) modes by doubling the number of coverage samples per pixel, while keeping the same number of color/depth/stencil samples.



The new EQAA modes can be enabled by selecting the 2xEQ, 4xEQ, or 8xEQ modes that have been added to the anti-aliasing slider in the AMD Catalyst™ Control Center. EQAA is fully compatible with all other supported anti-aliasing techniques, including Adaptive AA, Super-Sample AA, Custom Filter AA (Edge-Detect), and Morphological AA.

Selecting the Enhanced Application Settings option from the drop-down box will cause applications that natively support MSAA modes to use equivalent EQAA modes instead.



Selecting the Override Application Settings option will force applications to use EQAA modes if they are selected on the slider; this setting will often work even if an application does not natively support anti-aliasing.

The following table lists the number of color/depth/stencil and coverage samples used by the available MSAA and EQAA modes.

Anti-Aliasing Mode	Color/Depth/Stencil per pixel	Coverage Samples per pixel
2x	2	2
2xEQ	2	4
4x	4	4
4xEQ	4	8
8x	8	8
8xEQ	8	16

Morphological Filtering (MLAA)

The new morphological anti-aliasing technique works as a post process effect. In other words, we finish rendering each frame normally, but before presenting it to the display, we run it through another shader pass to perform the filtering. This differs from traditional multi-sample and super-sample AA techniques where the filtering occurs during the rendering of each frame. In fact, this technique can eliminate aliasing for still images, though it's intended to work better when in motion. MLAA can be enabled via the "All 3D settings" tab within the AMD Catalyst™ Control Center. The filter works by first detecting high contrast edges with various pixel-sized patterns that are normally associated with aliasing, and assumes they should actually be straight lines that are not aligned to pixel edges. It then estimates the length and angle of the ideal line for each edge, and determines the proportional coverage by the lighter and darker color for each pixel along the edge. Finally, it uses this coverage information to blend the colors for each pixel.

FrameLock and Genlock (AMD FirePro™ V7900)

FrameLock and Genlock are two related capabilities that are delivered in the ATI and AMD FirePro™ line of professional graphics cards with the addition of the ATI FirePro S400 synchronization module.



The ability to 'output lock' the displays of one or more GPUs is central to both of the capabilities; this means ensuring that the display outputs are locked (the pixels, lines and vertical syncs are updated at precisely the same time).

Genlock is the ability display outputs locked to an external reference, such as a black-burst generator (the term 'genlock' is a contraction of 'generator lock') that is commonly used in broadcast environments. This allows displays to be perfectly synchronized to incoming video signals and/or to on-set cameras that might be capturing displayed data (the cameras are also genlocked).

FrameLock is the ability to synchronize 3D rendering across multiple displays, multiple GPUs and even multiple machines. Applications that leverage frameLock (made available through OpenGL) can thus render their outputs across large numbers of displays, delivering a seamless canvas of 3D content. This capability is widely used in data visualization centers (caves, visualization rooms), simulators, and increasingly in broadcast powerwalls.

The combination of AMD Eyefinity technology with the ATI FirePro S400's ability to synchronize up to four GPUs in one chassis means that up to 24 synchronized displays can be driven from a single machine. The AMD FirePro V7900's single-slot form factor with four outputs allows for 16 synchronized displays to be driven from a single machine with an unprecedented low-power and small form factor.



Product Specifications

The following table provides a summary of the capabilities of the new AMD FirePro™ professional graphics products. For comparison, specifications of the previous generation products are also provided.

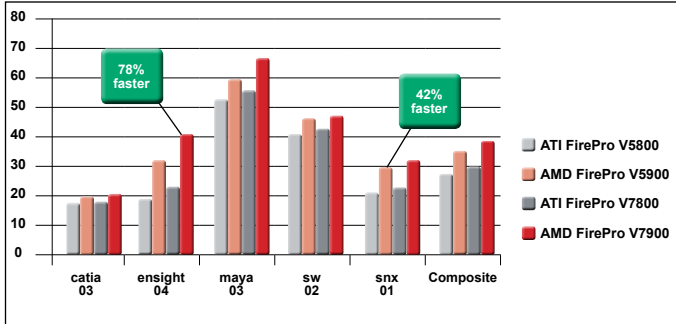
Product Specifications				
	ATI FirePro V5800	AMD FirePro V5900	ATI FirePro V7800	AMD FirePro V7900
GPU				
Stream Processors	800	512	1440	1280
Memory Interface	128-bit	256-bit	256-bit	256-bit
AMD GeometryBoost Technology	-	Yes	-	Yes
Triangle Rate (Mtriangles/s)	690	1200	700	1450
Memory				
Size/Type	1 GB GDDR5	2 GB GDDR5	2 GB GDDR5	2 GB GDDR5
Bandwidth (GB/s)	64	64	128	160
Display Outputs				
DisplayPort	2	2	2	4
Dual-link DVI (native)	1	1	1	-
Max Resolution	2560x1600 @ 60Hz	2560x1600 @ 60Hz	2560x1600 @ 60Hz	2560x1600 @ 60Hz
Stereo (OpenGL Quad-Buffer)	Yes	Yes	Yes	Yes
Stereo (3-pin DIN)	Not supported	Not supported	Not supported	Add-on connector (included)
API / Feature / OS Support				
DirectX®	11	11	11	11
OpenGL	4.1	4.1	4.1	4.1
Shader Model	5.0	5.0	5.0	5.0
AMD Eyefinity Technology Support	Yes	Yes	Yes	Yes
CrossfirePro	Yes	Yes	Yes	Yes
Framelock/Genlock	-	-	Yes	Yes
Stream Computing Support	OpenCL™ 1.1	OpenCL 1.1 (compliance expected)	OpenCL 1.1	OpenCL 1.1 (compliance expected)
OS Support	Windows® 7, Windows XP, Windows Vista, Linux® (32-bit and 64-bit OSes supported)	Windows 7, Windows XP, Windows Vista, Linux (32-bit and 64-bit OSes supported)	Windows 7, Windows XP, Windows Vista, Linux (32-bit and 64-bit OSes supported)	Windows 7, Windows XP, Windows Vista, Linux (32-bit and 64-bit OSes supported)
Thermal/Power/Form Factor				
Max Power	74W	<75W	138W	<150W
Slot(s)	1	1	1	1
Form Factor	ATX form factor, 9" (L) x 4.5" (H)	9" x 4.5"	11" x 4.5"	11" x 4.5"
Bus Interface	PCI Express 2.0 x16	PCI Express 2.1 x16	PCI Express 2.0 x16	PCI Express 2.1 x16
Retail Package Contents				
Common to All:	All Retail Packages contain: <ul style="list-style-type: none"> • Professional Graphics Card • Installation CD with drivers and documentation • Quick Start Reference Guide • AMD CrossFire™ connector 			
Display Adapters	One DP to DVI (single link) adapter One DVI to VGA adapter	One DP to DVI (single link active) adapter One DVI to VGA adapter	1 x DP to DVI (single link passive)	4 x DP to DVI (single link active)
ISV Certifications <p style="text-align: center;">All major CAD and DCC applications visit http://support.amd.com/us/gpudownload/fire/certified/Pages/certified-applications.aspx for complete listing.</p> <p style="text-align: center;">Note that many certifications for AMD FirePro V7900 and V5900 are pending and will be updated during the weeks after initial product launch.</p>				

Performance Testing

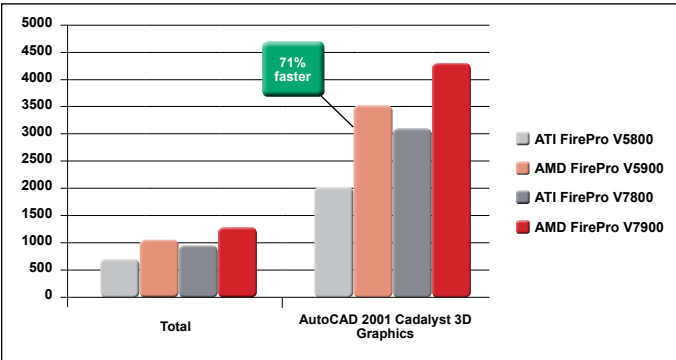
A sampling of a few key data points is shown in the charts below. These show comparisons of the AMD FirePro™ V7900 and V5900 professional graphics cards as compared to their predecessors, the ATI FirePro V7800 and V5800 respectively.

The reader is strongly encouraged to review AMD's guides on synthetic and application benchmarks before running any performance tests on these cards.

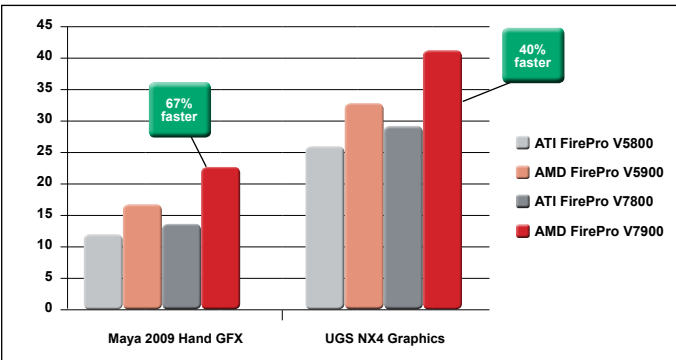
SPECviewperf 11 Subtests and Composite Scores



Catalyst 2011 Benchmark – AutoCAD 2011



SPECapc Maya 2009 and SPECapc UGS NX4 Benchmarks



Performance Measurement Information

All performance data was gathered using the following hardware/software configuration:

- HP Z400 Workstation
- Intel Xeon W3680 CPU @ 3.33GHz
- 8GB RAM
- Microsoft Windows 7 64 bit
- Driver: 8.83.5.3 beta1

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