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HP Z WORKSTATIONS
POWERED BY AMD FIREPRO GRAPHICS

OPTIMIZED FOR CAD

sponsored by HP and AMD FirePro™

CAD-OPTIMIZED PERFORMANCE

With a high GHz CPU, optimized AMD FirePro GPU, an acoustically engineered chassis and impressive serviceability, the HP Z440 Workstation is an ideal choice for 3D CAD

MEMORY (RAM)

16GB of DDR4 memory is considered to be a good amount for mainstream CAD while 32GB is recommended for particularly complex datasets.

With modern product development workflows it is important to consider that multiple applications may be running at the same time, which will also have an impact on memory use. With eight DIMM slots and a maximum capacity of 128GB[5] the HP Z440 is able to support complex workflows now and well into the future.

ECC (Error Correcting Code) memory is recommended for the highest quality results and it is important that memory is properly configured. To get the best performance out of the HP Z440's 4-channel memory architecture, install DIMMs in quads.

ACOUSTICS

To help ensure the HP Z440 is both quiet and reliable fans are strategically placed for optimum system cooling with advanced algorithms used to control fan speeds.

GRAPHICS PROCESSING UNIT (GPU)

A professional Graphics Processing Unit (GPU) is essential if you want high quality, interactive 3D graphics for CAD on a fully tested and certified platform. AMD FirePro professional GPUs and the drivers that control them are tuned to deliver optimized 3D performance, reliability and image quality that cannot be matched by consumer GPUs.

The HP Z440 Workstation supports a wide range of AMD FirePro W-Series GPUs, including the AMD FirePro W2100 (2GB), AMD FirePro W5100 (4GB), AMD FirePro W7100 (8GB) and AMD FirePro W9100 (16GB). AMD FirePro GPUs feature AMD's Graphics Core Next (GCN) architecture, which is designed to make optimal use of resources for maximum performance. This is particularly important when using features that improve image quality such as Full Scene Anti Aliasing, shadows, reflections and ambient occlusion (advanced real time lighting), even on 4K displays like the HP Z27s.

AMD FirePro GPUs support the latest OpenGL 4.4, DirectX 12 and AMD Mantle APIs to help deliver full compatibility with the latest CAD tools now and in the future. Support for OpenCL 1.2 means AMD FirePro GPUs are also optimized for compute, and can be used to carry out single precision operations (such as ray trace rendering), and double precision operations (such as simulation - FEA).

GPU memory is becoming increasingly important for 3D graphics. Vertex Buffer Objects (VBOs), a technology used by modern CAD applications, allows 3D geometry to be directly stored and modified in GPU memory, which helps increase performance. It is not uncommon for some applications and datasets to need more than 1GB to run at full speed.

The AMD FirePro W2100 (2GB) is a good option for entry-level CAD, while the AMD FirePro W5100 (4GB) is well matched to mainstream CAD workflows. For high-end CAD users, particularly those who want to push the boundaries of real time visualization, check out the AMD FirePro W7100 (8GB).
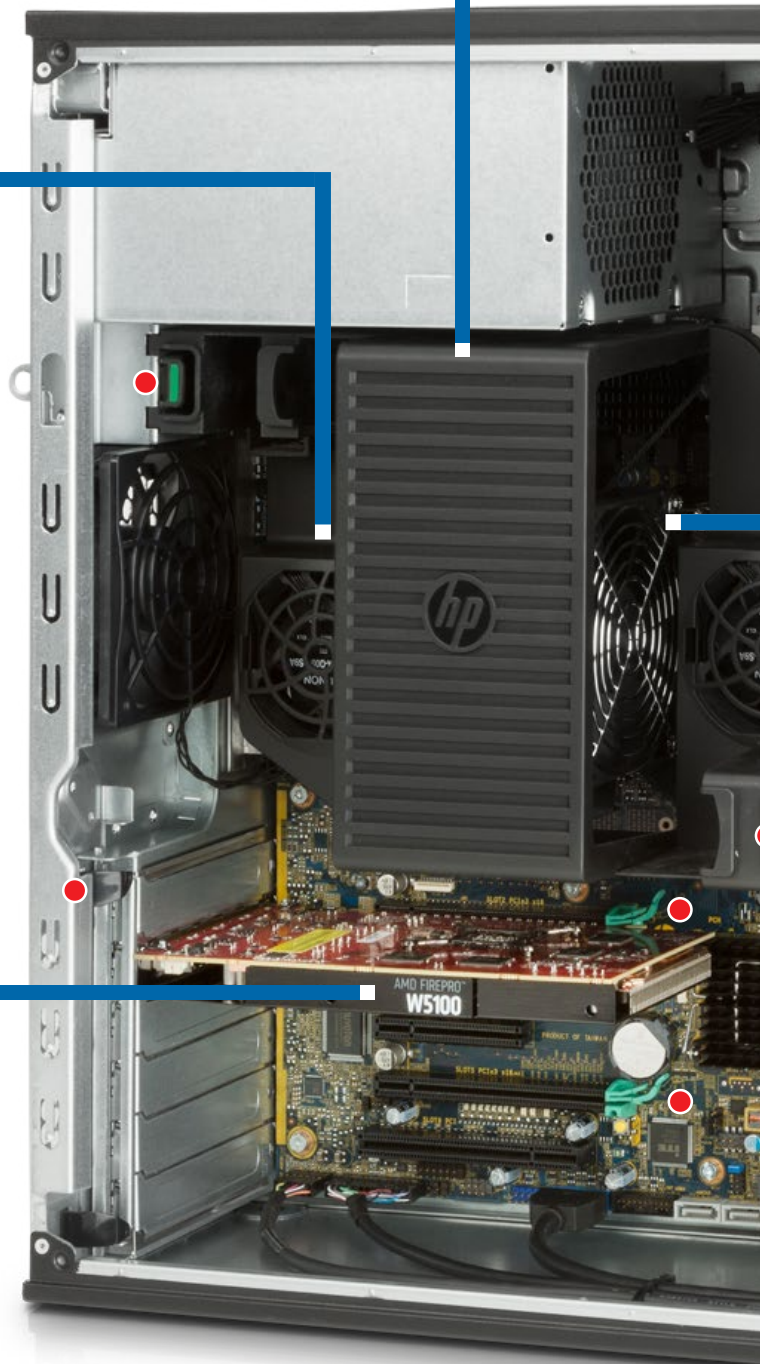
PROCESSOR (CPU)

The CPU is one of the most important components in an HP Z Workstation. For design and engineering, the two most significant specifications are clock speed (GHz) and the number of CPU cores.

Clock speed should be the number one priority for Computer Aided Design (CAD). A high GHz CPU will not only make most operations within the CAD software run faster, but it will increase the 3D graphics performance as well.

Some elements of CAD software are multi-threaded (i.e. they can take advantage of multiple CPU cores) but not many will take advantage of more than 2 or 3 cores. With this in mind an HP Z440 workstation with a quad core Intel® Xeon® E5-1630 v3 (3.7GHz) or Intel® Xeon® E5-1620 v3 (3.5GHz) is an excellent choice for mainstream CAD.

If you often perform background processing or use 'highly-threaded' simulation or ray trace rendering applications you should consider choosing a workstation with more CPU cores. Adding more cores does generally mean a reduction in GHz so it is important to find a good balance here.

An HP Z440 Workstation with an Intel® Xeon® E5-1680 v3 CPU (3.2GHz, 8 cores) is a good choice for entry-level simulation or rendering. High-end users should consider the dual socket HP Z640 Workstation with two Intel® Xeon® E5-2697 v3 CPUs (2.6GHz, 14 cores).

SERVICING ●

Many of the user-serviceable components, including hard drives, PCI/PCIe expansion slots, and external device bays, don't need a screwdriver to remove and replace, making configuration and upgrades easy.

All serviceable components clip in and out of position easily and are clearly marked with green touch points.

INTEGRATED HANDLES

Integrated handles at the front and rear make it easy to move the workstation around the office or into a rack

MEDIA CARD READER

Optional 15-in-1 Media Card Reader

I/O PORTS

Four well spaced USB 3.0 ports make it easy to plug in chunky USB memory sticks. The top port is 'always on' so smart phones and other devices can be charged even when the HP Z440 is off.

Four USB 3.0 and two USB 2.0 ports are also available at the rear of the machine as well as an optional Thunderbolt 2 port, which is powered by a Thunderbolt 2 PCIe 1-port I/O card.

STORAGE (SSDs AND HDDs)

A Solid State Drive (SSD) is recommended for optimal storage performance. Large datasets should load and save quicker and, as latency is low, the HP Z440 Workstation should feel more responsive. Random read / write access is also fast, which is particularly important when multi-tasking or swapping between applications.

SSDs traditionally come as 2.5-inch drives that use the SATA 3.0 interface. The HP Z440 has room for four of these drives. However, with four times the read performance of SATA 3.0 SSDs the HP Z Turbo Drive G2 SSD, a half height, half length PCIe card, should be of particular interest to those working with large datasets, typically used in point cloud processing, simulation or design visualization.
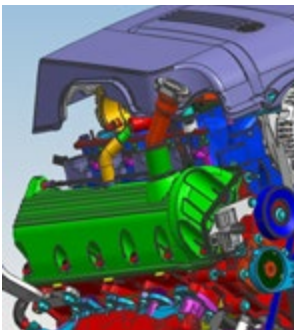
While SSDs offer superior performance to traditional hard disk drives (HDDs), their cost per GB is still relatively high. As a result, an SSD is commonly reserved for operating system, applications and current datasets, while a high capacity HDD drive is used to store data.
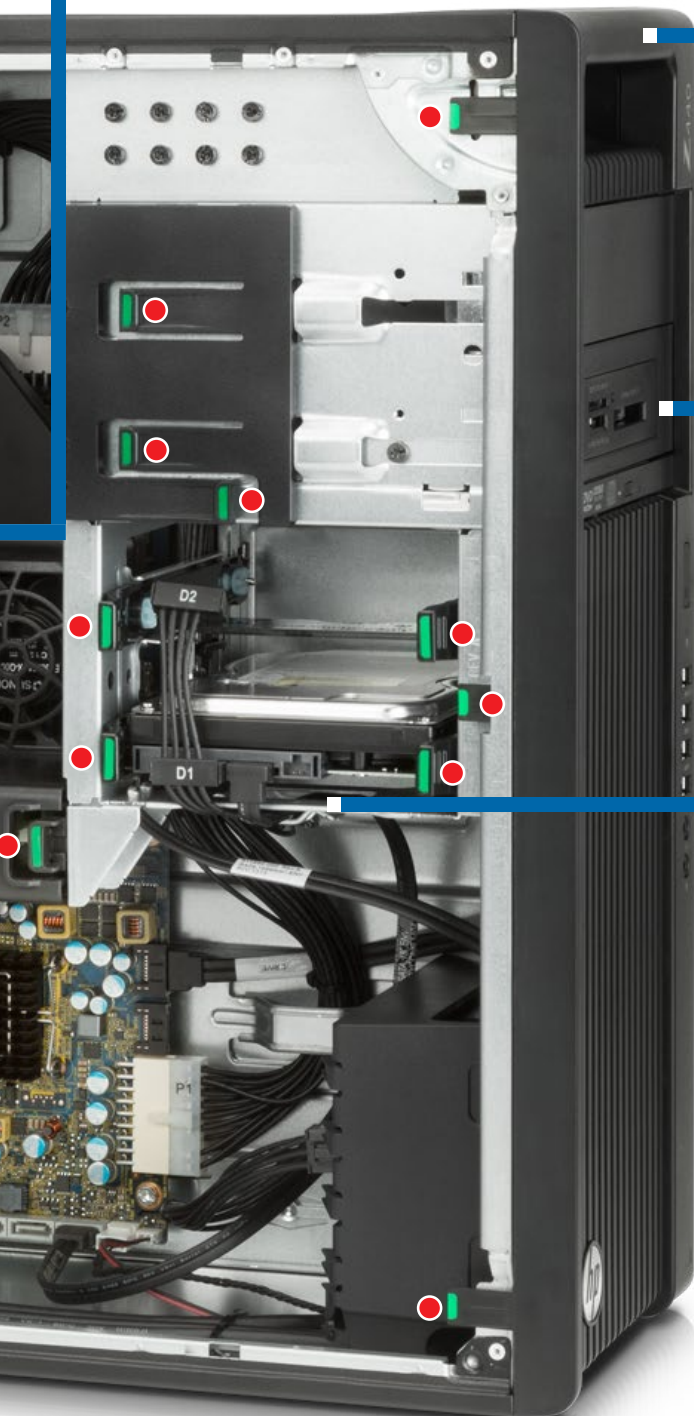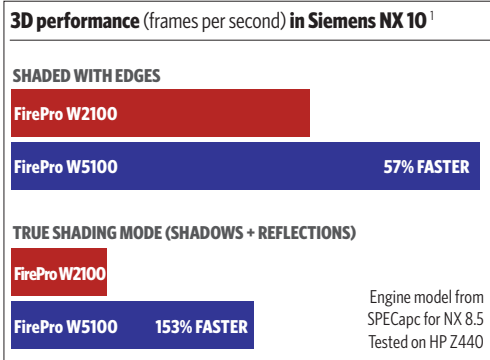
HP Z WORKSTATIONS: SIEMENS NX™ 10

With a strong footing in the automotive, aerospace and consumer products sectors, Siemens NX relies on powerful workstation hardware that is capable of handling huge assemblies comprising 1,000s of parts

Engine model - Shaded with Edges

Engine model - True Shading

3D performance (frames per second) **in Siemens NX 10** [1]

SHADED WITH EDGES

FirePro W2100	
FirePro W5100	57% FASTER

TRUE SHADING MODE (SHADOWS + REFLECTIONS)

FirePro W2100	
FirePro W5100	153% FASTER

Engine model from SPECapc for NX 8.5 Tested on HP Z440

TRUE SHADING
True Shading mode in NX 10 makes 3D models appear more realistic by applying shadows, reflections, transparency and advanced lighting in "real-time". However, viewing large assemblies in True Studio can put much higher demands on the GPU.

AMD FirePro GPUs can help increase the visual quality inside the NX modelling environment while maintaining interactivity with the model and keeping the application responsive.

RECOMMENDED SPEC FOR SIEMENS NX CAD WORKFLOWS

HP Z WORKSTATION
HP Z440 single CPU desktop workstation

PROCESSOR (CPU)
Intel® Xeon® E5-1630 v3 (3.7GHz) (4 core)
Intel® Xeon® E5-1620 v3 (3.5GHz) (4 core)

MEMORY (RAM)
16GB (for mainstream assemblies)
24-32GB (for large assembly modelling)

STORAGE (CPU)
256GB SATA Solid State Drive (SSD) or 256GB HP Z Turbo Drive G2 SSD for Windows 7 64-bit operating system, Siemens NX and supporting applications + 2TB SATA Hard Disk Drive (HDD) for data.

GRAPHICS CARD (GPU)
AMD FirePro W5100 (4GB) or W7100 (8GB) for complex assemblies, particularly when viewing models in Advanced Studio mode or

in stereo. GPU is certified and optimized for Siemens NX for performance and stability.

ADVANCED USERS
For CAD and rendering (Ray Traced Studio) Intel® Xeon® E5-1680 v3 (3.2GHz) (8 cores). For CAD and simulation (NX Nastran). AMD FirePro W9100 [10] (16GB) — NX Nastran calculations can be accelerated by GPU (as well as CPU). One FirePro GPU can deliver 3D graphics and simulation at the same time.

The AMD FirePro W7100 (8GB) is a good choice for large assembly modelling in Siemens NX 10

ORDER INDEPENDENT TRANSPARENCY (OIT)

Order Independent Transparency (OIT) is a display technology featured in SOLIDWORKS 2014 and 2015 that uses the GPU to render semi-transparent objects faster and more accurately.

Prior to OIT, the CPU was used to calculate the display order of transparent objects, which was slower and more prone to errors.

In SOLIDWORKS 2015, OIT also allows users to see parts and assemblies in context in greyscale, directly from the feature tree, before enabling them for edit. This gives great user feedback on which parts and assemblies you want to enable instead of just a bounding box.

OIT requires a professional GPU, such as AMD FirePro. At least 2GB of on-board memory is recommended, such as the AMD FirePro W2100 or above.

HP Z WORKSTATIONS: SOLIDWORKS® 2015

Used extensively in the design of industrial machinery, consumer products, and medical devices SOLIDWORKS demands powerful workstation hardware that can handle complex assemblies with an emphasis on aesthetics
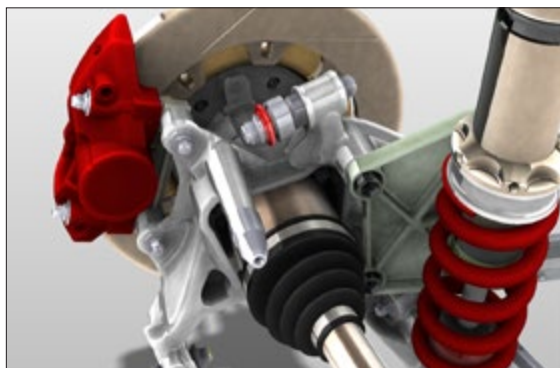
Relative performance in SOLIDWORKS 2015 (bigger is better) [2]

SOLIDWORKS 2015 benchmark Tested on HP Z440

SHADED WITH EDGES
AMD FirePro W2100
AMD FirePro W5100 — **64% FASTER**

SHADED WITH EDGES + REALVIEW
AMD FirePro W2100
AMD FirePro W5100 — **87% FASTER**

SHADED WITH EDGES + REALVIEW + SHADOWS + AMBIENT OCCLUSION
AMD FirePro W2100
AMD FirePro W5100 — **170% FASTER**

REALVIEW & AMBIENT OCCLUSION
SOLIDWORKS RealView brings models to life through advanced real time shading. Ambient Occlusion (AO) further increases the realism of viewport models by better simulating real world lighting.

A professional GPU is required to enable RealView and AO and as both technologies put a significant load on the GPU, models will rotate more smoothly with more powerful GPUs. See chart left for performance comparison of GPUs.

RECOMMENDED SPEC FOR SOLIDWORKS CAD WORKFLOWS

HP Z WORKSTATION
HP Z440 single CPU desktop workstation

PROCESSOR (CPU)
Intel® Xeon® E5-1630 v3 (3.7GHz) (4 core)
Intel® Xeon® E5-1620 v3 (3.5GHz) (4 core)

MEMORY (RAM)
16GB (for mainstream assemblies)
24GB (for large assembly modelling)

STORAGE (CPU)
256GB SATA Solid State Drive (SSD) or 256GB HP Z Turbo Drive G2 SSD for Windows 7 64-bit operating system, SOLIDWORKS and supporting applications + 2TB SATA Hard Disk Drive for data.

GRAPHICS CARD (GPU)
AMD FirePro W2100 (2GB) for entry-level part and assembly modelling.
AMD FirePro W5100 (2GB) for complex

assemblies, and with RealView or Ambient Occlusion enabled (see above). Both GPUs are certified and optimized for SOLIDWORKS for performance and stability.

ADVANCED USERS
For CAD and SOLIDWORKS Simulation Intel® Xeon® E5-1650 v3 (3.5GHz) (6 cores). For CAD and SOLIDWORKS PhotoView 360 (ray trace rendering) Intel® Xeon® E5-1680 v3 (3.2GHz) (8 cores).
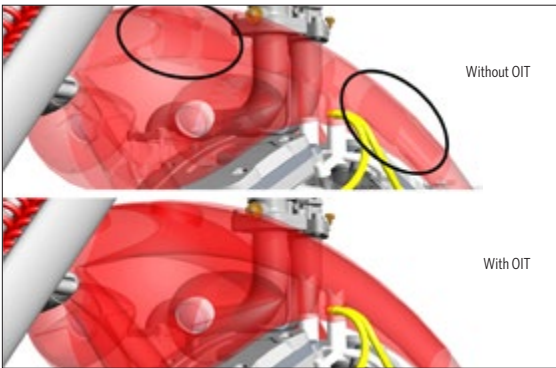

The AMD FirePro W2100 is ideal for entry-level part and assembly modelling
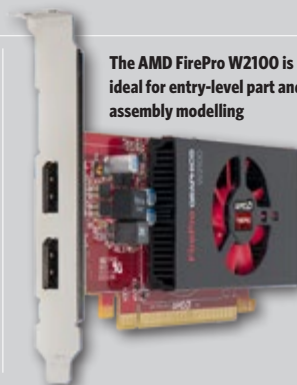
HP Z WORKSTATIONS: PTC CREO® 3.0

With a firm foundation in automotive (powertrain), consumer products and heavy machinery, PTC Creo 3.0 demands powerful workstation hardware to make light work of exceedingly complex assemblies

Without OIT

With OIT

Relative 3D performance in PTC Creo 3.0 (bigger is better) [3]

SPECapc for Creo PTC 3.0 benchmark
Tested on HP Z440

SHADED WITH EDGES

FirePro W2100	
FirePro W5100	200% FASTER

SHADED REFLECTION MODE 8X AA WITH OIT AND COMPLEX LIGHTING

FirePro W2100	
FirePro W5100	247% FASTER

GPU-ACCELERATED TRANSPARENCY
Order Independent Transparency (OIT) is a display technology featured in PTC Creo 2.0 and 3.0 that uses the GPU to render semi-transparent objects faster and more accurately.

Prior to OIT, the CPU was used to calculate the display order of transparent objects, which was slower and more prone to errors. OIT requires a professional GPU, such as the AMD FirePro W5100. At least 2GB of on-board memory is recommended.

RECOMMENDED SPEC FOR PTC CREO 3.0 CAD WORKFLOWS

HP Z WORKSTATION
HP Z440 single CPU desktop workstation

PROCESSOR (CPU)
Intel® Xeon® E5-1630 v3 (3.7GHz) (4 core)
Intel® Xeon® E5-1620 v3 (3.5GHz) (4 core)

MEMORY (RAM)
16GB (for mainstream assemblies)
24-32GB (for large assembly modelling)

STORAGE (CPU)
256GB SATA Solid State Drive (SSD) or 256GB HP Z Turbo Drive G2 SSD for Windows 7 64-bit operating system, PTC Creo 3.0 and supporting applications + 2TB SATA Hard Disk Drive (HDD) for data.

GRAPHICS CARD (GPU)
AMD FirePro W5100 (4GB) for complex assemblies, particularly when viewing models with higher quality settings

or transparency. GPU is certified and optimized for PTC Creo for performance and stability.

ADVANCED USERS
For CAD and photorealistic rendering
Intel® Xeon® E5-1680 v3 (3.2GHz) (8 cores).

For CAD and simulation (Creo Simulate).
Intel® Xeon® E5-1650 v3 (3.5GHz) (6 cores).

The AMD FirePro W5100 (4GB) is a good choice for mainstream modelling in PTC Creo 3.0

AMD FIREPRO: OPTIMIZING PROFESSIONAL CAD

With an advanced engineering team working behind the scenes AMD FirePro is influencing the future of CAD

AMD FirePro graphics isn't just about fast GPUs and optimized drivers. The AMD FirePro engineering team also directly influences the future of graphics within the CAD tools themselves.

AMD works closely with CAD software developers to help implement new graphics technologies that improve 3D performance and model fidelity.

AMD played a key role in integrating Vertex Buffer Objects (VBOs) inside the graphics engines of PTC Creo, CATIA, SOLIDWORKS, and others. VBOs allow 3D geometry to be directly stored in graphics memory which helps boost performance.

OIT (Order Independent Transparency) used in PTC Creo and SOLIDWORKS, is another technology whose adoption has been directly influenced by AMD.
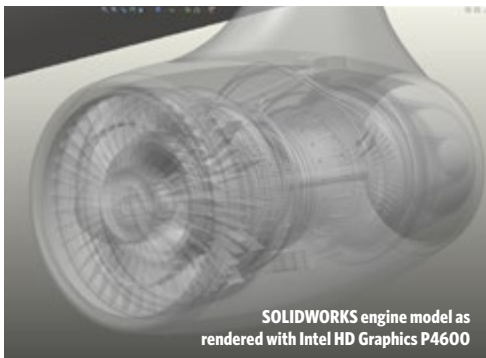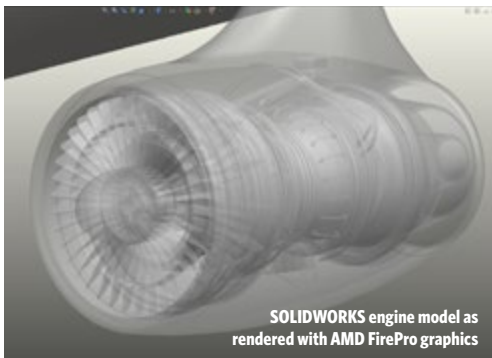
AMD was so instrumental in embedding this technology in PTC Creo that it was the only GPU manufacturer to support OIT in PTC Creo 2.0.

It is long standing relationships like these that help give AMD FirePro an edge in CAD, even with the entry-level FirePro W2100 — compared right to Intel® HD Graphics P4600, the graphics technology embedded in many of the Intel® Xeon® CPUs on offer in the HP Z230 Workstation.

SOLIDWORKS 2015 BENCHMARK with FSAA (bigger is better) [4]

Shaded with edges	Intel HD Graphics P4600	Tested on HP Z230 Workstation with Intel® Xeon® E3-1245 v3
	130% faster AMD FirePro W2100	
	220% faster AMD FirePro W5100	
Shaded with edges + RealView	Intel HD Graphics P4600	
	152% faster AMD FirePro W2100	
	300% faster AMD FirePro W5100	
Shaded with edges + RealView + Shadows + Ambient Occlusion	Intel HD Graphics P4600	
	99% faster AMD FirePro W2100	
	AMD FirePro W5100 **412% faster**	

SOLIDWORKS engine model as rendered with AMD FirePro graphics

SOLIDWORKS engine model as rendered with Intel HD Graphics P4600

CRYSTAL CLEAR

AMD was instrumental in the development of Order Independent Transparency (OIT) for PTC Creo, for rendering semi-transparent objects.

To the left we see a jet engine model as viewed with two different GPUs. With the AMD FirePro GPU the transparency is rendered very accurately. With the Intel HD Graphics P4600, which does not support OIT, it is harder to perceive depth and the relative position of parts.

TUNE YOUR HP Z WORKSTATION
FOR YOUR CAD WORKFLOWS

HP Performance Advisor, an HP tool for performance optimization, delivers a simple, effective way to keep your HP Workstation operating at its peak potential.

A software wizard can take you from initial configuration and customization through the optimization of your system for a variety of CAD tools.

It can help ensure you are using the best certified graphics driver for your installed applications, optimized for performance and

stability. It can offer advice and apply BIOS settings. For example, enabling Intel Hyper-Threading[8] to get maximum performance when ray trace rendering scenes.

It can also help you gain a quick and accurate understanding of your entire system in one simple interface, and then help identify bottlenecks by tracking use of memory, CPU and other resources. This can help ensure maximum performance throughout the entire life of your HP Z Workstation.

HP Performance Advisor features an interactive block diagram to give a crystal clear picture of all the components inside your HP Z Workstation.

HP Z WORKSTATIONS FOR CAD/CAM/CAE

	HP Z230 (TOWER) Workstation performance and reliability at starting prices that rival desktop PCs. Entry-level to mainstream 3D CAD, including SOLIDWORKS.	**HP Z440** High levels of performance and expandability in an accessible tool-free mini-tower form factor. Mainstream to high-end 3D CAD (mainstream simulation, design visualization or CAM)	**HP Z840** Dual-socket workstation delivers exceptional performance, industrial design, and tool-free serviceability. High-end simulation, design visualization or CAM
Processor	Intel® Xeon® E3-1241 v3 (3.5GHz, 3.9GHz Turbo, 4 Core) [6]	Intel® Xeon® E5-1630 v3 (3.7GHz, 3.8GHz Turbo, 4 Core) [6]	2x Intel® Xeon® E5-2687 v3 (3.1GHz, 3.5GHz Turbo, 10 Core) [6]
Memory	16GB DDR3 1600 MHz ECC RAM [7]	32GB DDR4 2133MHz ECC RAM [7]	128GB DDR4 2133MHz ECC RAM [7]
GPU	AMD FirePro W2100 (2GB)	AMD FirePro W5100 (4GB) or AMD FirePro W7100 (8GB)	AMD FirePro W5100 (4GB) or AMD FirePro W7100 (8GB)
Storage	Z Turbo Drive 256GB [9]	Z Turbo Drive 256GB and 2TB SATA HDD [9]	Z Turbo Drive 512GB and 2TB SATA HDD [9]

Screen images courtesy of AMD, DEVELOP3D, Factory Five Racing, PTC and Local Motors.

1. Based on comparison of AMD FirePro W2100 and W5100 running DEVELOP3D internal benchmark with FRAPS on Siemens NX 10 using the SPECapc for Siemens NX 8.5 Engine dataset and "shaded with edges" mode and True Shading Mode (shadows + reflections). Test machine: HP Z440 Workstation, Intel® Xeon® E5-1650 v3 at 3.5GHz (four cores), 32GB RAM, Windows 7 64-bit SP1, Siemens NX 10.0.0.24. Tests were run July 2015 by DEVELOP3D.

2. Based on comparison of AMD FirePro W2100 and W5100 running DEVELOP3D internal benchmark for SOLIDWORKS 2015 with Full Scene Anti Aliasing (FSAA) and 'shaded with edges' mode, 'shaded with edges + RealView' mode and 'shaded with edges + RealView + Shadows + Ambient Occlusion' mode. Test machine: HP Z440 Workstation, Intel® Xeon® E5-1650 v3 at 3.5GHz (four cores), 32GB RAM, Windows 7 64-bit SP1, SOLIDWORKS 2015 SP2. Tests were run July 2015 by DEVELOP3D.

3. Based on comparison of AMD FirePro W2100 and W5100 running SPECapc for PTC Creo 3.0 benchmark and 'shaded with edges' mode and 'shaded reflection mode 8x AA with OIT and complex lighting'. Test machine: HP Z440 Workstation, Intel® Xeon® E5-1650 v3 at 3.5GHz (four cores), 32GB RAM, Windows 7 64-bit SP1, PTC Creo 3.0 M010. AMD FirePro driver 14.502.1032. Tests were run July 2015 by DEVELOP3D.

4. Based on comparison of AMD FirePro W2100, AMD FirePro W5100 and Intel HD Graphics P4600 running DEVELOP3D internal benchmark for SOLIDWORKS 2015 with Full Scene Anti Aliasing (FSAA) and 'shaded with edges' mode, 'shaded with edges + RealView' mode and 'shaded with edges + RealView + Shadows + Ambient Occlusion' mode. Test machine: HP Z230 Workstation, Intel® Xeon® E3-1245 v3 at 3.4GHz (four cores), 32GB RAM, Windows 7 64-bit SP1, SOLIDWORKS 2015 SP2. AMD FirePro driver: 14.502.1032. Intel HD Graphics driver: 10.18.10.3960. Tests were run July 2015 by DEVELOP3D.

5. Maximum memory capacities assume Windows 64-bit operating systems or Linux. With Windows 32-bit operating systems, memory above 3 GB may not all be available due to system resource requirements.

6. Multi-Core is designed to improve performance of certain software products. Not all customers or software applications will necessarily benefit from use of this technology. 64-bit computing on Intel. architecture requires a computer system with a processor, chipset, BIOS, operating system, device drivers, and applications enabled for Intel® 64 architecture. Processors will not operate (including 32-bit operation) without an Intel® 64 architecture enabled BIOS. Performance will vary depending on your hardware and software configurations. Intel's numbering is not a measurement of higher performance. See intel.com/info/em64t for more information.

7. Intel® Xeon® E3, Intel® Xeon® E5, Intel Core i3 and Intel Pentium processors can support either ECC or non-ECC memory. Intel Core i5 and i7 processors only support non-ECC memory.

8. Intel® Hyper-Threading - The hyper-threading feature is designed to improve performance of multi-threaded software products; please contact your software provider to determine software compatibility. Not all customers or software applications will benefit from the use of hyperthreading. Go to intel.com/info/hyperthreading for more information, including which processors support HT Technology.

9. For hard drives and solid state drives, 1 GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 10 GB of system disk (for Windows 7) is reserved for system recovery software.

10. AMD FirePro W9100 availability pending testing and certification on HP Z640 and HP Z840 workstations.

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