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Compaq Computer Corporation

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Compaq Workstations Graphics Product Positioning

Abstract: This paper covers all graphics options certified for use with Compaq Professional and Deskpro Workstations. This paper also introduces updated information regarding Compaq's Graphics Excellence Program and how this program stands to usher in a new age of customer choice for the 21st century. It provides an overview of the benefits of and defines how Compaq delivers the widest selection of powerful graphics solutions for nearly every customer type and requirement.

It provides a new comparison framework for considering the various levels of price, performance, functionality and features available on each of two classes of graphics. This paper includes product features, positioning and comparisons between products and recommended selection criteria based on application usage and customer environments and perspectives.

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Compaq Professional Workstations Graphics Product Positioning
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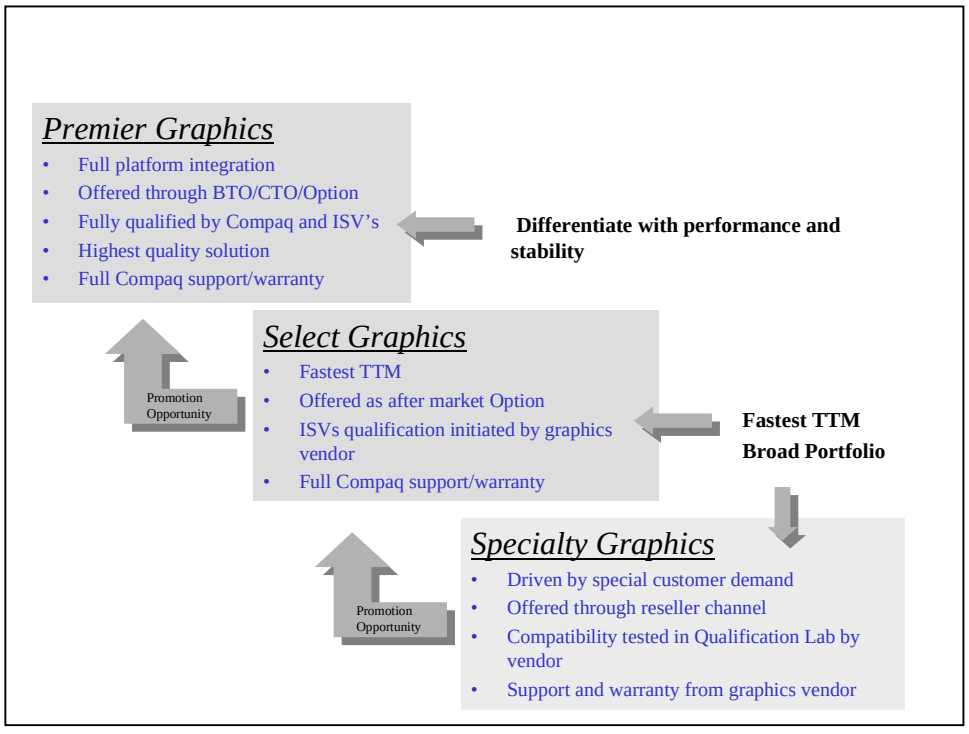
Introduction

The workstation market is renowned for its high performance, highly specialized capabilities, however it also shares many of the attributes of the mature and largely commoditized PC market. As such, the workstation market should not be considered one solitary mass, but is more like a market of many sub-markets. This diversity has spawned a need for a diverse set of graphics solutions—some of which are fairly basic and akin to traditional desktop PC graphics solutions and some that are highly specialized for the often-unique tasks that have been the traditional domain of RISC-based UNIX workstations. It has also spawned a need for a flexible way to deliver these solutions to market. After all, no one vendor could possible develop solutions for all of the varied requirements of such as massive collection of customer needs.

Compaq has created a way to meet these varied market requirements. The Graphics Excellence Program (GEP) is the most critical element of Compaq's ability to continue to drive the broadest portfolio of graphics solutions in the market to address the need for a diverse array of workstation graphics solutions. It allows Compaq to efficiently extend its line and solutions portfolio and enables solutions that otherwise would not enjoy broad recognition. This program also allows Compaq to bring the latest graphics technologies to market faster without sacrificing compatibility and stability. Compaq uses the three-tiered GEP approach to enable this flexibility in the most efficient manner possible. Consider each in turn, from the niche oriented Specialty graphics solutions to the more strategic, higher volume Select and Premier solutions.

Figure 1: The three tiers of the Compaq Graphics Excellence Program



Specialty Graphics

This is the entry-level in the Graphics Excellence Program. Controllers offered as specialty solutions are tested on Compaq platforms, but are not sold by Compaq nor offered as Compaq options. This class of graphics solution is integrated by resellers or elsewhere in the channel and the warranty for the graphics is provided by the graphics hardware vendor. Generally, these devices appeal to narrow market segments, and as such are best delivered and integrated by specific, focused value-added channels. The key benefit of this program is that it allows customers to get the graphics controllers that meet specific requirements or preferences and still receive the performance and peace of mind of the Compaq quality workstation platform. This approach also allows Compaq to get new graphics solutions to market quickly and efficiently, with less stringent testing requirements (for example bypassing some of Compaq's detailed platform environmental, thermal and mechanical analyses).

Having identified a solution opportunity in the market, Compaq invites the graphics solution developer to spend a week in the new, dedicated GEP lab in Littleton, MA for joint testing with Compaq's segment, graphics and platform engineers. There, the combined teams work through a menu of configuration and application options, logging, diagnosing and troubleshooting any issues in tandem. Critical functionality and parameters that are often part of the test plan are operating systems such as Windows NT, Windows 98, Windows 2000 and Linux. Compaq is also interested in thoroughly understanding the controllers' application performance and general platform interoperability. Once testing is complete, any issues that have not been resolved by the end of the graphics partner visits are logged and assigned for resolution based on the nature of the problem. Representatives from both sides are constantly in contact to assure smooth reconciliation of outstanding debug work even after the joint testing has been completed. Only after both parties are satisfied is certification granted.

Select Graphics

The next level of the Graphics Excellence Program is the Select Level. These controllers are more strategic products that are more thoroughly tested for compatibility with the Compaq workstation platforms. The Select Graphics solution is the primary vehicle for Compaq to be the first to market with key new graphics technologies. Examples of this class of solution include the Matrox G200 Quad MMS controller for multiple-display configurations and the industry-leading ELSA GLoria II graphics controller. Compaq and its channels offer this class of product as a Compaq after-market option and these devices are covered under Compaq warranties. Select solutions are not only qualified and profiled in the GEP lab but are also scrutinized by Compaq platform and segment engineering teams for overall quality. These solutions are also the top candidates to promotion to Premier status based on market performance and platform refresh schedules. In fact, Compaq has already seen that the best of these Select solutions, such as the Matrox Millennium G400 DualHead and the Intense3D Wildcat 4110 PRO can be rapidly elevated to the top tier of the GEP program.

Premier Graphics

The Premier level is where Compaq applies the most stringent testing and where it delivers the solutions that appeal to the broadest base of users. Premier level graphics are preinstalled on Compaq Professional Workstations and/or offered by Compaq and its channels as after-market options. These are typically the highest performance, fullest-featured, highest quality graphics

components and offer the full Compaq warranty, providing uncompromising stability and cost of ownership.

The Premier graphics partners are Compaq's closest allies and these integrated solutions and option kits meet the needs of roughly 80 percent of the market. This is also where Compaq invests most heavily in terms of its partner relationships. While these solutions pass through the GEP lab, Compaq also spends months working closely with the graphics vendor and professional ISVs to tune and integrate the solutions.

This tiered approach is a pragmatic way to make investments and position and deliver solutions in an increasingly fragmented market. But while delivery and integration of solutions are key consideration points for customers, it is also important to understand the relative merits and positioning of the controllers based on technical merits. After all, the workstation and graphics markets were both built upon a foundation of technical excellence. The following sections outline the customer requirements and technical capabilities that help position Compaq's graphics solutions for key market segments.

Market Requirements

As a corollary to the merging of the commodity PC space and the historical technical computing market dominated by specialized workstation products, it is understandable to consider the customer requirements for workstation graphics in two broad categories, each of which spans the more traditional performance-oriented delineations for graphics (e.g 2D, Multi-display 2D and 3D controllers). The best way to think about these two classes are to apply labels based on customer attributes. Compaq considers these classes as those with basic "Productivity" requirements and those with more demanding "Performance" requirements. Essentially, these can be defined as follows:

Productivity customers

Productivity customers are best represented by the class of users that have traditionally purchased highest performance PCs for maximum computing power, and are moving up to Intel-based workstation for more of the same. Another set of these customers may be moving to NT workstations from RISC platforms used where performance graphics were not available or required, such as Sun Ultra 5 or SPARCstation or IBM RS/6000 systems used for risk management, financial trading, ECAD and publishing. These customers too were typically purchasing workstations for compute performance or to suit application requirements for operating system support or SCSI storage subsystems. In general, these customers seek the best value available when it comes to graphics and believe that price/performance is critical in the consideration set. Since the planned usage probably does not stress graphics performance with large models or unique feature requirements (as per the legacy of the users), these customers will typically sacrifice some features found in higher-end "Performance" solutions. Also for this reason, and perhaps because many of these customers plan to run on homegrown applications, many also believe that application certification is not a critical requirement for this class of product.

Since graphics performance has historically not been a bottleneck or a key purchase consideration, many of this class of customer consider graphics controller branding a secondary if

not totally unimportant criterion in the decision process. Generally, these customers would prefer stability (platform and graphics) and uniformity to "latest and greatest" speed and functionality.

Performance customers

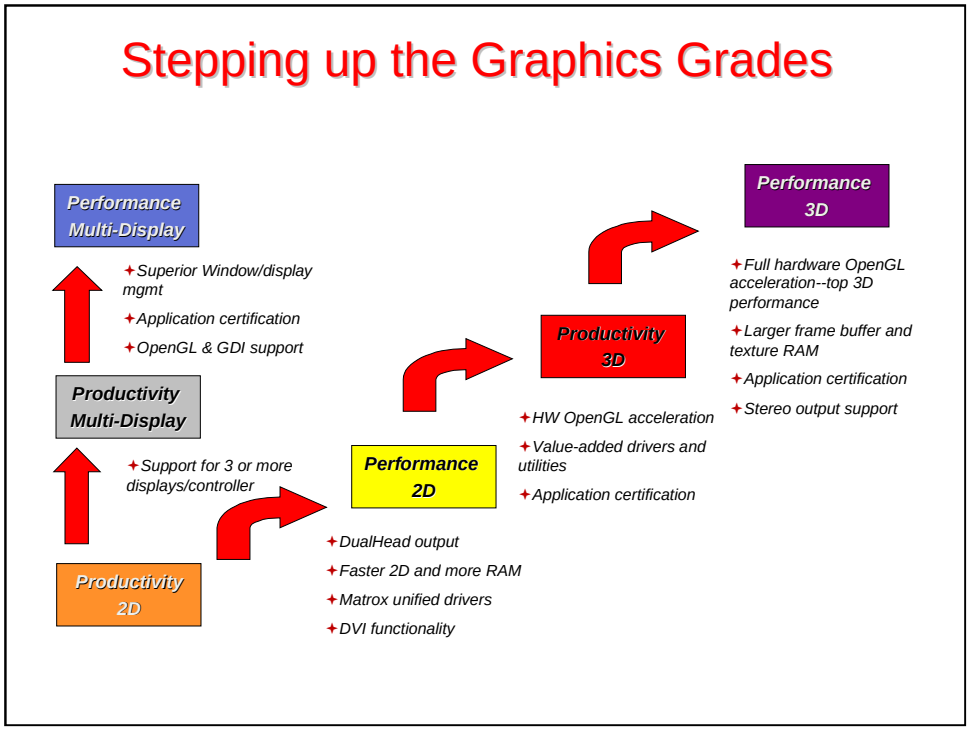
Performance customers have specific requirements for their graphics controllers and in general are far more dependent on obtaining the "ideal" solution for their needs. These customers have typically purchased specialized or highly modified PCs to meet unique implementation requirements. Additionally, many more of this class of customer has traditionally purchased high performance graphics workstations such as SGI Indy or Octane systems, HP VISUALIZE systems or Sun Ultra 2 products for high end MCAD, Imaging, Animation or Geoscience applications. Considering the great demands placed on the graphics subsystems and the high value of the visual output, customers in this section will only reluctantly make concessions in graphics choices. In fact, these customers place significant emphasis and priority on graphics as part of purchase criteria.

"Performance" oriented customers generally prefer established graphics OEM brand(s), and have often found or developed application-level optimizations for these solutions that in many ways 'lock them in" to a given brand of solution. They are often willing to pay for unified or value-add drivers that improve the performance and/or stability of the graphics environment. And as a follow on it stands to reason that they would require graphics that are tested and certified with their key applications.

Because so much of their business is riding on data visualization and optimal responsiveness of graphics subsystems, these customers demand the fastest graphics solutions available for their applications. Moreover, they are also much more likely to require graphics with advanced feature sets and functionality to meet user or application requirements. Such enhancements could include features such as dual display support, display management software, Digital Visual Interface (DVI) output, stereo support, large texture memory or hardware-based full scene antialiasing.

Compaq provides an array of solutions to meet needs in each of these classes. The following sections place each of Compaq's Premier, Select and Specialty graphics solutions in the context of the appropriate customer segment and provides an overview of the functionality, performance and pricing that justifies this positioning.

Figure 2: The Performance Solutions add Value of the Basic Functionality of the Productivity Solutions



Productivity Graphics Solutions

Compaq offers a selection of graphics controllers designed to meet the needs of customers with basic graphics requirements that span 2D, multi-display 2D and even 3D graphics. These controllers are aggressively priced, yet offer strong (though not top of the line) performance and functionality levels. As such, these solutions generally offer compelling value and excellent price/performance for a broad range of customers. But it is important to remember that the Productivity class of solution often requires trade-offs in performance, scalability or functionality to achieve lower prices.

2D Graphics

For productivity 2D requirements, Compaq offers the ATI Rage Pro Turbo graphics controller on select Compaq Deskpro Workstation AP240 systems. The ATI Rage Pro Turbo provides a basic 2D environment suitable for general office computing, software development, entry ECAD or network management applications where workstation-class compute horsepower and expandability is required. And since the ATI Rage Pro Turbo graphics infrastructure is quite common in many brands of commercial PCs, customers appreciate the benefits of deploying a single graphics technology and driver set across PC and workstation user bases. Additionally, since this graphics technology is so common, and does not require a host of costly hardware features, it is relatively inexpensive, providing an excellent value for customers that do not require additional performance or functionality.

For a complete overview of the features and functionality provided by the ATI Rage Pro Turbo controller, please visit:

http://www.ati.com/na/pages/products/pc/xpert@work/index.html

Multi-Display 2D Graphics Controllers

Compaq has just announced availability of the Matrox G200 Quad MMS graphics controller, that essentially replaces the older Matrox Productiva G100 Quad MMS solution on the new Compaq Deskpro Workstation AP250 and Compaq Professional Workstation AP550 and SP750. The G200 Quad MMS delivers a new level of performance and functionality for customers requiring a cost-effective 4-port graphics solution. The Matrox G200 Quad MMS delivers multi-display performance in 2D, GDI and DirectDraw and Direct3D applications for business users seeking maximum display area. This is the preferred solution for customers with requirements for three or more displays, such as EDA engineers or financial traders.

The Matrox G200 Quad MMS is also the first multi-port controller capable of driving up to four Digital Visual Interface (DVI) digital output displays. DVI displays provide top quality digital video clarity at up to 1280 x 1024 resolution per display. The Matrox G200 Quad MMS controller kit comes complete with the quad output controller and either two analog or two DVI digital cables that enable support for four displays out-of-the box. For optimal investment protection, the analog controller kit is upgradeable to DVI output through a simple cable-swap upgrade. The Matrox G200 Quad MMS also includes Matrox's highly regarded PowerDesk software suite, enabling basic control of all of the elements of multi-display visual computing. PowerDesk enables single control panel access to manage features such as color and resolution, dialog box and other vital window management functions that become increasingly important to boosting productivity in multi-display environments.

For a complete overview of the features and functionality provided by the Matrox G200 Quad MMS controller, please visit:

http://www.compaq.com/products/workstations/graphics/multi2d.html

3D Graphics Controllers

Compaq offers a compelling 3D controller for customers seeking strong performance with a reduced feature set at a low cost. The ELSA Synergy II offered by Compaq is an excellent solution for workstation professionals running CAD, DCC, and GIS applications—especially if these tasks tend to focus on small models or datasets or wireframe or aliased renderings of larger models. There is a direct trade-off of performance for model/scene complexity when considering the utility of the Productivity solutions. But this is no bare-bones solution, as it features a unified frame buffer of 32MB of memory, and is capable of supporting resolutions as high as 1920 x 1200 in 24-bit double-buffered mode with a 24-bit Z-buffer, 8 stencil planes, and hardware texturing capabilities allowing the display of very realistic images.

The ELSA Synergy II offers a rich OpenGL implementation including hardware triangle setup, texture blending support, and support for vector anti-aliasing in hardware, as well as an OpenGL software implementation that has been optimized for and tested with numerous workstation applications.

ELSA has also provided a multitude of software tools and utilities that enhance the functionality of the Synergy II, making ELSA's solution the most robust productivity 3D offering in the industry. Combining the powerful *n*VIDIA RIVA TNT 2 processor with ELSA's enhanced software package provides an excellent solution for CAD applications, such as Autodesk

AutoCAD and PTC Pro/ENGINEER, as well as DCC applications, such as Discreet MAX, Discreet Edit, and NewTek Lightwave 3D.

For a complete overview of the features and functionality provided by the ELSA Synergy II productivity 3D controller, please visit:

http://www.compaq.com/products/workstations/graphics/pro3d.html

Performance Graphics Solutions

Compaq offers an impressive selection of graphics controllers designed to meet the needs of customers with specific feature-rich, high-performance graphics requirements that span 2D, multi-display 2D and 3D graphics. These controllers are competitive priced and offer outstanding performance, enhanced software environments and unique functionality for the most demanding workstation environments. As such, these solutions are generally targeted to the customer set with mission and business critical workstation requirements and in environments where specific graphics brands and/or technologies are justified.

Performance 2D Graphics Controllers

Compaq offers three solutions in the Performance 2D controller arena, and two of these are Premier solutions based on the Matrox MGA-G400 graphics engine. Compaq offers the Matrox Millennium G400 single display controller and the Matrox Millennium G400 DualHead controller on the Deskpro Workstation AP250 and Professional Workstation AP550 and SP750. The Matrox Millennium G400 AGP graphics accelerator draws upon the established excellence of previous generation Matrox graphics and raises the bar on 2D graphics performance and features. In the most demanding professional and business applications, these controllers combine superior performance, image quality, and support for new graphics processing techniques in one easy-to-use, easy to install solution. The new Matrox G400 delivers exceptional 2D performance, providing a compelling alternative to the older Matrox Millennium G200 and for customers seeking Matrox performance and stability or optional digital display output (via an add-on daughtercard). The Matrox Millennium G400 DualHead provides the most powerful multi-display 2D environment in the market today, and is the best choice for customers powering two analog displays from a single AGP controller. Both Matrox solutions are ideally suited to high performance office application environments, while the DualHead functionality offers particular advantages for DCC, EDA and Finance customers.

For a complete overview of the features and functionality provided by the Matrox Millennium G400 family of Performance 2D controllers, please visit:

http://www.compaq.com/products/workstations/graphics/multi2d.html

Performance Multi-Display Graphics Controllers

Compaq's solution in the Performance Multi-Display graphics space is a Specialty solution enabled under the Compaq GEP. This solution is the Appian Gemini dual display controller. The Gemini is based on the S3 Savage/MX controller technology and is Appian's price/performance leader. The Appian Gemini controller is available from Appian or its resellers and can be integrated on Compaq selectable graphics SKUs. This controller is rapidly emerging as a favorite solution for DCC and financial market customers that appreciate the strong 2D and entry 3D

performance, impressive feature set and market-leading display management software--HydraVision. The Gemini is a PCI controller, allowing customers to add multiple controllers to support additional displays. Compaq and Appian have worked closely to ensure that channel partners can confidently integrate the market-leading technologies from each into a powerful, robust solution for customers. The Appian Gemini dual display controller has been certified for compatibility on the Compaq Deskpro Workstation AP250 and Compaq Professional Workstation AP550 systems.

For an overview of the features and functionality provided by the Appian Gemini Performance 2D controller, please visit Appian at:

http://www.appiangraphics.com/products/

Performance 3D Graphics Controllers

Compaq currently offers four performance 3D graphics solutions, the 3Dlabs Oxygen GVX1, the Compaq PowerStorm 600 (also known as the Intense3D Wildcat 4000), the new ELSA GLoria II and the Intense3D Wildcat 4110 Pro. Each offers some impressive features and performance capabilities that make it a preferred solution for certain classes of customers. In general, this class of controller is targeted at the most demanding, power-hungry 3D graphics professionals.

The 3Dlabs Oxygen GVX1 graphics controller is a high performance 3D graphics solution for users who require professional-quality 3D graphics features but are also compelled by solutions with the best balance of price and performance. In short, this solution is the lowest-performance solution in this class, but also the least expensive. The 3Dlabs Oxygen GVX1 is based on the 3Dlabs GLINT R3 graphic rendering controller and GLINT Gamma geometry processor. The combination of the GLINT R3 and GLINT Gamma on the Oxygen GVX1 makes this graphics controller an ideal choice for 3D-application performance for CAD, CAM, DCC, GIS, solids modeling and visual data analysis applications, especially when medium sized datasets and models are used. The 3Dlabs Oxygen GVX1 graphics controller is available in an AGP ATX form factor or PCI form factor, which can be combined with the AGP version for dual-display support. This is a key selling feature and differentiator for customers such as Discrete MAX users that truly benefit from a multi-display environment. As an additional benefit, both a standard VGA connector and digital flat panel (Panel Link) connector are standard on the Oxygen GVX1, giving customers added display output flexibility that is not available on many other comparable products. The AGP-based Oxygen GVX1 is supported as a Premier graphics solution on selected Compaq Professional Workstations running Windows NT 4.0, while the PCI controller is offered as a Select solution.

For a complete overview of the features and functionality provided by the 3Dlabs Oxygen GVX1 family of Performance 3D controllers, please visit:

http://www.compaq.com/products/workstations/graphics/pro3d.html

Compaq also provides customers with the Compaq PowerStorm 600 as a solution for performance 3D application requirements. The Compaq PowerStorm 600 is based on the Wildcat™ 4000 graphics controller from Intense3D. The Wildcat 4000 is the controller that firmly planted Intergraph technology as the top dog in 3D graphics performance as measured by SPECViewperf benchmarks and key applications such as Pro/ENGINEER. It provides powerful graphics features and performance for CAD, CAM, CAE, DCC, GIS and visual data analysis applications. This is the highest performance 3D solution available for Compaq Professional Workstation AP500 and SP700 customers.

The Compaq PowerStorm 600 graphics controller is available as a Premier solution on select Compaq Professional Workstation AP500, AP550, SP700 and SP750 models. For a complete overview of the features and functionality provided by the Compaq PowerStorm 600 Performance 3D controller, please visit:

http://www.compaq.com/products/workstations/graphics/pro3d.html

Compaq is also pleased to offer the ELSA GLoria II as a Select graphics solution for integration with the Deskpro Workstation AP250 and Professional Workstation AP550 and SP750 systems. The ELSA GLoria II AGP graphics controller is a powerful, high performance 3D graphics solution for Professional 3D users who require a rich feature set and the best balance of price and performance. In fact, the GLoria II offers better than two times the performance of the Oxygen GVX1 at a similar price point. Based upon industry leading chip technology, the Quadro™ Graphics Processing Unit (GPU) from *n*VIDIA , the ELSA GLoria II offers many key features including: uncompromising OpenGL performance, AGP 2X/4X support, high-resolution support in true color mode, optimized OpenGL drivers, and a unified frame buffer with 64MB of SDRAM. This unified frame buffer has the ability to support up to 24-bits double buffered with a 24-bit Z-buffer, 8-bit double buffered overlay planes, 8-bit double buffered alpha planes, and 8 stencil planes simultaneously. As such, the GLoria II suffers little performance degradation as model complexity or datasets are increased. The *ELSA Gloria II* is targeted at CAD, CAM, DCC, and GIS, solids modeling and visual data analysis applications requiring high performance and a full selection of hardware accelerated features.

For a complete overview of the features and functionality provided by the ELSA GLoria II Performance 3D controller, please visit:

http://www.compaq.com/products/workstations/graphics/pro3d.html

The Intense3D Wildcat 4110 Pro was announced in November 1999 as a Select graphics solution, and is now available as Premier solution integrated on some models of the Compaq Professional Workstation AP550 and SP750. This graphics controller delivers up to twice the performance of the previous Wildcat 4000 accelerators (Compaq PowerStorm 600) and is the OpenGL 3D graphics performance leader for demanding design, engineering, and DCC professionals who are working with large data models in real-time. In fact, the Wildcat 4110 Pro (along with the new Compaq workstations with Intel Pentium III and Pentium III Xeon 733 MHz processors, 840 core logic chipset) and are now the industry's leading graphics Windows NT workstation solution based on the SPEC Viewperf benchmark suite, outperforming all comparably configured Windows NT/Intel *and* UNIX/RISC workstations on the market today. The Intense3D Wildcat 4110 PRO is an AGP-Pro50 version the Wildcat 4110 and can only be installed in systems that have an AGP-Pro slot. The Wildcat 4110 Pro is the "single pipeline" version of the Wildcat Parascale™ architecture and includes a single geometry accelerator and single render engine.

The Intense3D Wildcat 4110 Pro provides optimized support for OpenGL 1.2 under Windows NT 4.0 and incorporates support for both analog monitors and digital DVI-based flat panel displays, providing high performance with impressive display output flexibility. With its extreme performance, large memory configurations and impressive selection of hardware-accelerated features, the Intense3D Wildcat 4110 Pro is an excellent solution for the most demanding DCC, MCAD, Geoscience and visual simulation application environments.

For a complete overview of the features and functionality provided by the Intense3D Wildcat 4110 Pro performance 3D controller, please visit:

http://www.compaq.com/products/workstations/graphics/pro3d.html

As one can see, Compaq has enabled the most robust selection of workstation graphics solutions in the market today. Compaq's array of solutions spans a full gamut of user needs for price, features, functionality and performance. This breadth of selection provides customers with optimal solutions to their complex and varied workstation requirements.

Figure 3: Compaq's Graphics Advantage Quantified

Compaq	Dell	HP	IBM
Matrox Millennium G200		Matrox Millennium G200	Matrox Millennium G200
Matrox G100 Quad MMS		Matrox G100 Quad MMS	
Matrox G200 Quad MMS		Matrox Millennium G250	
Matrox Millennium G400			
Matrox G400 DualHead	Matrox G400 MAX	Matrox G400 DualHead	Matrox G400 DualHead
Appian Gemini			
Appian Jeronimo Pro 2 Port	Appian Jeronimo Pro 2 Port		Appian Jeronimo Pro 2 Port
Appian Jeronimo Pro 4 Port	Appian Jeronimo Pro 4 Port		
ELSA Synergy II	Diamond Viper 770	ELSA Synergy II	
3Dlabs Oxygen VX1	ELSA Synergy Force	ELSA Synergy+	
Diamond Fire GL1	Diamond Fire GL 1	E&S AccelGalaxy	Diamond Fire GL 1
3Dlabs Oxygen GVX1		3Dlabs Oxygen GVX1	
ELSA GLoria II		HP VISUALIZE fx2+	ELSA GLoria II
Compaq PowerStorm 600 (Intense3D Wildcat 4000)	Intense3D Wildcat 4000	HP VISUALIZE fx4+	Intense3D Wildcat 4000
Intense3D Wildcat 4110 Pro	Intense3D Wildcat 4110 Pro	HP VISUALIZE fx6+	Intense3D Wildcat 4110 Pro

Appendix A Compaq Graphics Excellence Program Certified Solutions as of 2/15/2000

Premier	Select	Specialty
ATI Rage Pro Matrox Millennium G200* Matrox G400 single display and DualHead Matrox Productiva G100 Quad Multi-Monitor Series (MMS) ELSA Synergy II 3Dlabs Oxygen GVX1 Compaq PowerStorm 600 Intense3D Wildcat 4110 PRO	Matrox G200 Quad Multi-Monitor Series (MMS) ELSA GLoria II	3Dlabs Oxygen VX1* Diamond Fire GL1* Appian Jeronimo Pro* Appian Gemini

* Denotes a sustaining product not featured in this paper

Appendix B Compaq Graphics Support Matrix as of 2/15/2000

Graphics Device	CPW AP200	DPW AP240^	DPW AP250	CPW AP400	CPW AP500	CPW AP550	CPW SP700	CPW SP750
2D/MD2D Productivity& Performance								
ATI Rage Pro								
Matrox Millennium G400								
Matrox Millennium G400 DualHead								
Matrox Millennium G200								
Matrox G200 Quad MMS								
Appian Gemini								
Matrox Productiva G100 Quad								
3D Productivity								
Synergy II AGP - NT4								
Synergy+ AGP - NT4								
3D Performance								
ELSA GLoria II								
Oxygen GVX1 AGP								
Oxygen GVX1 PCI								
PowerStorm 600								
Intense3D Wildcat 4110 PRO								