ArcGIS® 3D Analyst™ Graphics Accelerator Cards

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Improving 3D graphics performance with ArcGIS 3D Analyst

Rendering performance in 3D scenes can be improved dramatically through the use of an OpenGL® graphics card. OpenGL is an industry-standard, cross-platform, 3D graphics application programming interface (API). Cards supporting this API offload compute-intensive tasks from the CPU and perform the operations in specialized hardware. A proper graphics card and graphics driver configuration is all that's necessary for 3D graphics performance to be improved in ESRI® ArcGIS™ 3D Analyst™. No special setting in 3D Analyst is required.

A variety of OpenGL cards are available. Their capabilities and prices vary. The following sections describe issues to be aware of when making purchasing decisions.

Level of support for OpenGL

Some cards support only a partial implementation of the OpenGL API, handling few tasks in hardware. Some 3D cards made for games and the Direct3D API do not have a good OpenGL implementation (if at all). Look for cards, and their drivers, which are designed and optimized for OpenGL to achieve the best performance.

Geometry setup

Geometry setup reduces load on CPU and graphics pipeline by accepting geometry data directly rather than requiring preprocessing by the CPU into a card-specific format. Requiring less use of the CPU and the graphics pipeline improves performance.

Geometry acceleration

This form of acceleration accepts geometry primitives (e.g., triangles), projects them into 3-D camera space, clips, illuminates, projects again to 2-D screen space, and rasterizes the result. It has a significant performance impact for data-intensive applications like geographic information systems (GISs).

Texture mapping

Texture mapping handles imagery in hardware. Images, such as those from satellites, orthophotos, scanned maps, and raster-based symbols can be rendered in real time when texture mapping is supported in hardware on the card. Texture memory controls the total amount of imagery that can be used at one time. If you ever intend to use imagery or raster-based symbols in your 3D GIS applications, you should consider a card that supports this feature. The card should have at least 16MB of RAM that can be dedicated to the task. This means the total memory of the card needs to be more than 16MB.

Z buffer resolution

Z buffer resolution controls how accurately the card can perform hidden surface removal. The minimum to be considered is 16 bit, with the highest and most accurate resolution being 32 bit. 3D Analyst requests a 24-bit z buffer but will work with values both higher and lower.

Output resolution, colors, and refresh rate

These control the size and quality of the resulting display on your monitor—the higher the better. Be aware that configuring a card to maximize one of its capabilities may diminish its capabilities in other areas. For example, just because a card supports a 24-bit color mode and 1280x1024 output resolution doesn't mean you can have them simultaneously. Also, depending on the card, increasing one of these parameters may impact memory available for other things such as textures.

Display driver

Display driver communicates display information from the application to the graphics hardware. Some display drivers for 3D cards have limited OpenGL support or none at all. Make sure an optimized OpenGL driver is available for the card that's designed to fully exploit the capabilities of the hardware. Compatibility issues can exist between driver, card, graphics bus, and operating system version. Check with the graphics card vendor for verification. In addition, look to the graphics card vendor for updates to drivers that ship with a card. These can enhance performance and resolve bugs.

Chipset

The primary factor influencing the capabilities and performance of a card is its chipset. Cards from different vendors who use the same chipset more than likely have similar capabilities and performance.

Graphic cards tested by ESRI

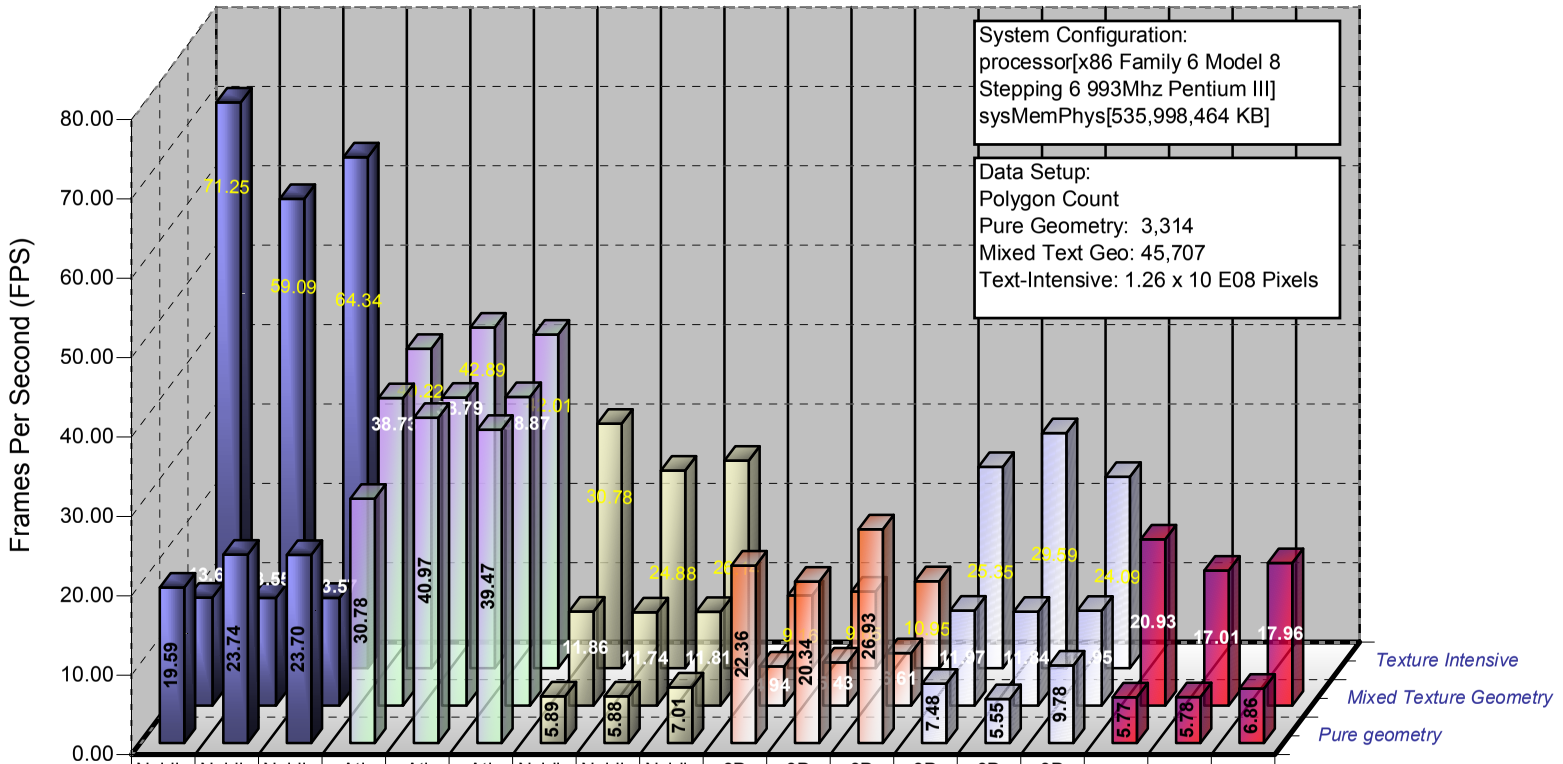
The following is a list of graphics cards, by manufacturer, that ESRI has used successfully* to improve rendering performance with 3D Analyst extension:

- 3Dlabs® Create!
- 3Dlabs Oxygen® GVX1 (and GVX1 Pro)
- 3D Prophet® II Pro GTS
- ATI FireGL2 ™
- ATI Radeon 8500 ™
- ATI RAGE Mobility™
- Compaq PowerStorm™
- Diamond Multimedia Viper® V770
- Diamond Multimedia Fire GL1 AGP
- Diamond Multimedia Fire GL™ 1000 PRO
- ELSA Synergy™
- ELSA GLoria™ II-64
- NVIDIA® GeForce2 GTS™
- NVIDIA GeForce2 Mx™
- NVIDIA GeForce3™
- NVIDIA Quadro2 Pro™

*Related to performance only, not rendering quality. Some cards improved performance more than others. In general, those with geometry setup and texture mapping support performed better. These cards have various restrictions that include operating system and graphics bus version. Check card requirements and your system configuration before purchasing.

The chart below indicates performance test on selected cards. As noted above the test is relevant to performance only.

Geometry & Texture Intensive Tests For Different Graphics Accelerators



Card Type	Nvidia GeForce3	Nvidia GeForce3	Nvidia GeForce3	Ati FireGL2	Ati FireGL2	Ati FireGL2	Nvidia Quadro2Pro	Nvidia Quadro2Pro	Nvidia Quadro2Pro	3D Labs Oxyge	3D Labs Oxyge	3D Labs Oxyge	3D Prophet	3D Prophet	3D Prophet	Radeon	Radeon	Radeon
Pure geometry	19.59	23.74	23.70	30.78	40.97	39.47	5.89	5.88	7.01	22.36	20.34	26.93	7.48	5.55	9.78	5.77	5.78	6.86
Mixed Texture Geometry	13.61	13.55	13.57	38.73	38.79	38.87	11.86	11.74	11.81	4.94	5.43	6.61	11.97	11.84	11.95	20.93	17.01	17.96
Texture Intensive	71.25	59.09	64.34	40.22	42.89	42.01	30.78	24.88	26.14	9.16	9.65	10.95	25.35	29.59	24.09	*	*	*

Card Details:
Nvidia GeForce3 - GeForce3 Integrated RAMDAC 64MB Driver Version: 6.13.10.2311 Video Architecture: VGA
ATI FireGL2 - IBM RC100 256-bi /IBM GT1000 Integrated RAMDAC 64MB
Nvidia Quadro2 Pro - GeForce 2 GTS 64MB Driver Version 6.13.10.2311
3D Labs Oxygen - Oxygen GVX1 Pro Integrated 300MHz RAMDAC 64MB Driver version: 2.16-0691
3D Prophet II Pro GTS - GeForce 2 Pro 400Mhz DDR RAM 64MB Driver Version
Radeon 8500 - ATI Radeon200 AGP (QL) Internal DAC (350Mhz) 64MB card Driver Version: 5.13.01.3276

* The Radeon 8500 Card did not complete this test as it was not able to render color while drawing complex polygons (polygons with more than 3 vertices) & traingle strips (as in the case in multipathces)