

ATI Radeon X700 XT 128 MB PCIe

by **John Reynolds**

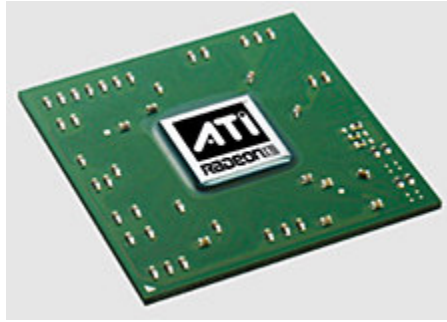
Introduction

The online gaming and hardware communities have a rather strong preoccupation with performance, a focus that emphasizes the high-end of product markets. Thus attention is predominantly given to the more expensive parts that attain the highest scores, that push existing systems to new levels of performance. Boutique vendors such as Falcon Northwest and Alienware cater almost exclusively to this market; larger OEMs like Dell, however, do not necessarily share that perspective, and instead give greater consideration to products that belong to the mainstream market. ATI's new Radeon X700 graphics chips are intended to address this section of the market and today SimHQ will be looking at the X700 XT. While the X700 board range is priced from \$149 to \$249, the X700 XT 128 MB MSRPs for \$199, a price tag that targets the more casual buyer of discrete add-in boards.



Based on the R420 architecture, the X700s (R410) are 120m transistor parts manufactured using TSMC's 110nm process. Die size plays a key role in manufacturing costs, and as chips designed for the mainstream segment the X700s lowered their transistor count down below that of the faster X800s primarily by reducing the number of pixel pipelines from 16 to 8. Likewise the memory interface has also been shrunk from 256- to 128-bits, though ATI's specifications of using fast GDDR3 RAM for the XT boards somewhat ameliorates the obvious impact the smaller interface has on memory bandwidth. A quick look at the X700 board lineup reads as follows:

	X700	X700 Pro	X700 XT	X700 XT
Pipelines	8 pipes	8 pipes	8 pipes	8 pipes
Clock speed	400 MHz	420 MHz	475 MHz	475 pipes
Pixel Fill-rate	3.2 GP	3.4 GP	3.8 GP	3.8 GP
On-board memory	128 MB	256 MB	128 MB	256 MB
Memory speed	300 MHz	432 MHz	525 MHz	525 MHz
Memory bandwidth	9.6 GB	13.8 GB	16.8 GB	16.8 GB
MSRP	\$149	\$199	\$199	\$249



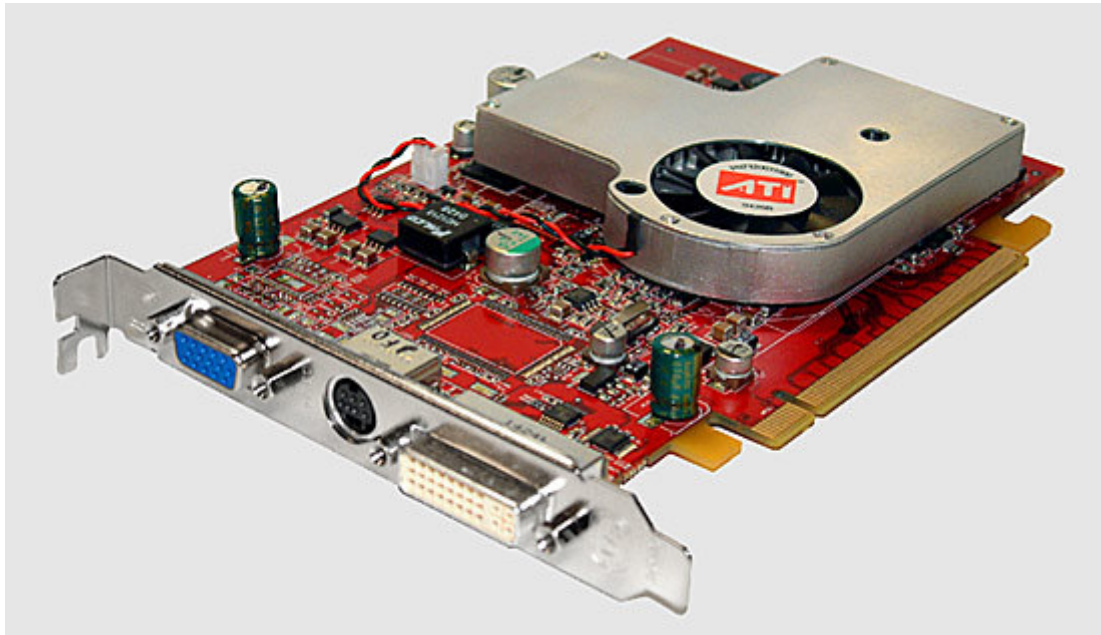
The X700 XTs ship with core clock speeds set very closely to those of the X800 boards, giving them a greater pixel fill-rate than last year's high-end graphics cards. Worth noting is that while the X700s have significantly lower fill-rates compared to the X800 boards, ATI has chosen to retain the same vertex engine setup for the X700s as the faster parts. In the past mainstream chips generally boasted two vertex shader units, and even last year's flagship 9700/9800 chips possessed only four vertex units, so the inclusion of all six is certainly an interesting decision since one could've reasonably expected to see this section of the architecture likewise halved. Also noteworthy is that the X700 boards are PCI Express only products; ATI is keen on addressing the mainstream market with these boards, which is already orientating itself rather quickly to the new bus. SimHQ suspects this decision could be a foreshadowing of things to come for future, next generation graphics boards, even the high-end cards, though only time will tell if this suspicion bears fruit. The review board ATI sent SimHQ is fairly small, barely 6.5 inches long, and bears a thin, L-shaped copper cooler with fan; the board also doesn't require a power connector since its requirements can be supplied by the PCIe slot itself.

X700 Architecture Overview

As previously mentioned, the X700 graphics chips are based on the same architecture as the X800s and are thus identical in terms of features supported and functionality as that of the faster parts. While the X700 graphics chips have half the pixel pipelines they do still offer two shader and one texture unit per pipe, the same as the X800s. The following is a brief specifications list for the X700s:

- **Smartshader HD** - support for DirectX 9.0 pixel and vertex shaders, multiple render targets (MRTs), and OpenGL support for complete feature set via extensions.
- **Smoothvision HD** - support for 2x/4x/6x programmable and temporal multisampling anti-aliasing modes, adaptive anisotropic filtering modes, and lossless color compression.
- **3Dc** - support for normal map compression (4:1).
- **Hyper Z HD** - support for hierarchical Z-buffer with early Z test, lossless Z-buffer compression, and fast Z-buffer clear.
- **Videoshader HD** - support for Real, DivX, and WMV9 formats, all-format DTV/HDTV decoding, and adaptive per-pixel de-interlacing and frame rate conversion.
- **Display Outputs** - dual integrated 400 Mhz DACs, integrated TV output up to 1024x768 resolution, and YprPb component output for HDTV support.

A more comprehensive features list for and description of the X700 architecture can be read in SimHQ's Radeon X800 XT review [here](#).



Test System Setup

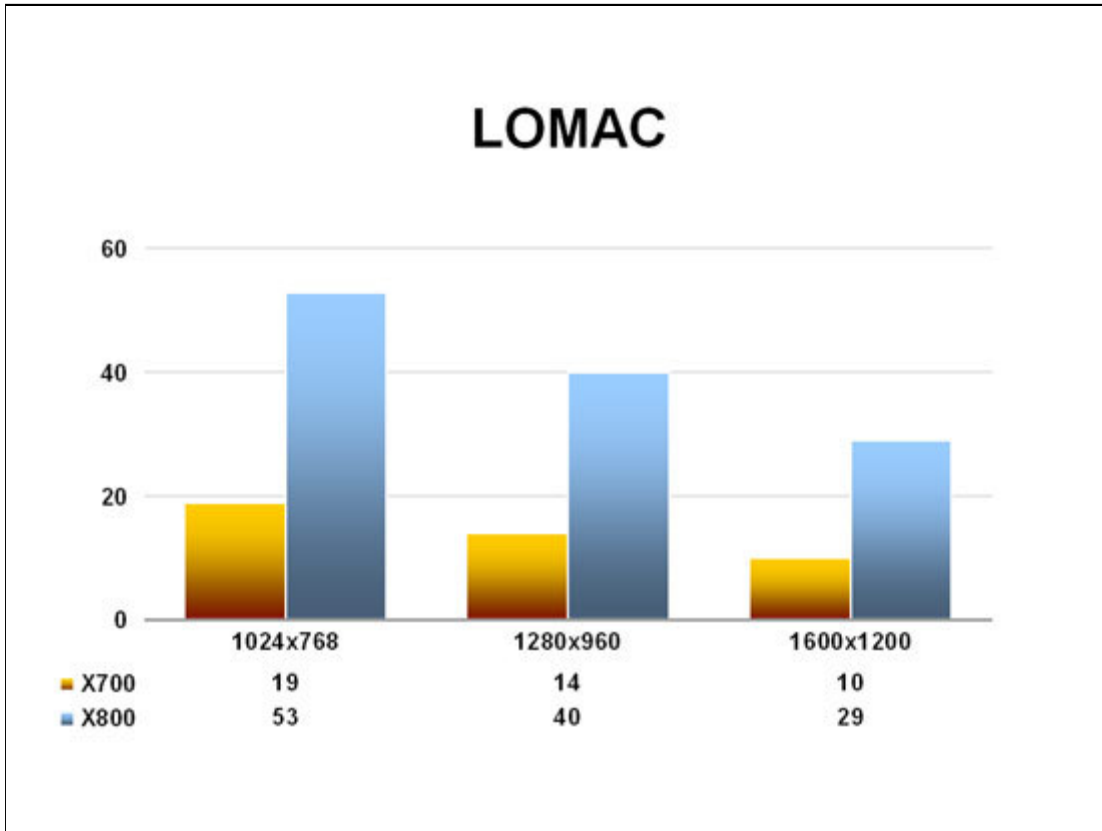
- Intel Pentium 4 3.46 GHz Extreme Edition processor
- Intel D925XECV2 (925XE chipset, 1066 Mhz FSB) motherboard
- 1 GB (2x512 MB) Micron DDR2 533 Mhz memory
- ATI Radeon X700 XT and X800 XT PCI Express graphics cards (Catalyst 4.11)
- Windows XP Professional (SP2)
- DirectX 9.0c

The benchmark suite used to evaluate this test system is listed [here](#). Again, unless specified otherwise all games are configured to their highest settings, and 32-bit color and trilinear texture filtering are the default baseline during testing. Also, Windows XP is configured to have Automatic Update, System Restore, and all unnecessary startup services disabled. Fraps 2.3.3 is used to record performance scores unless otherwise noted, and care is taken to ensure that ATI's A.I. optimizations are disabled during testing.

Benchmark Scores

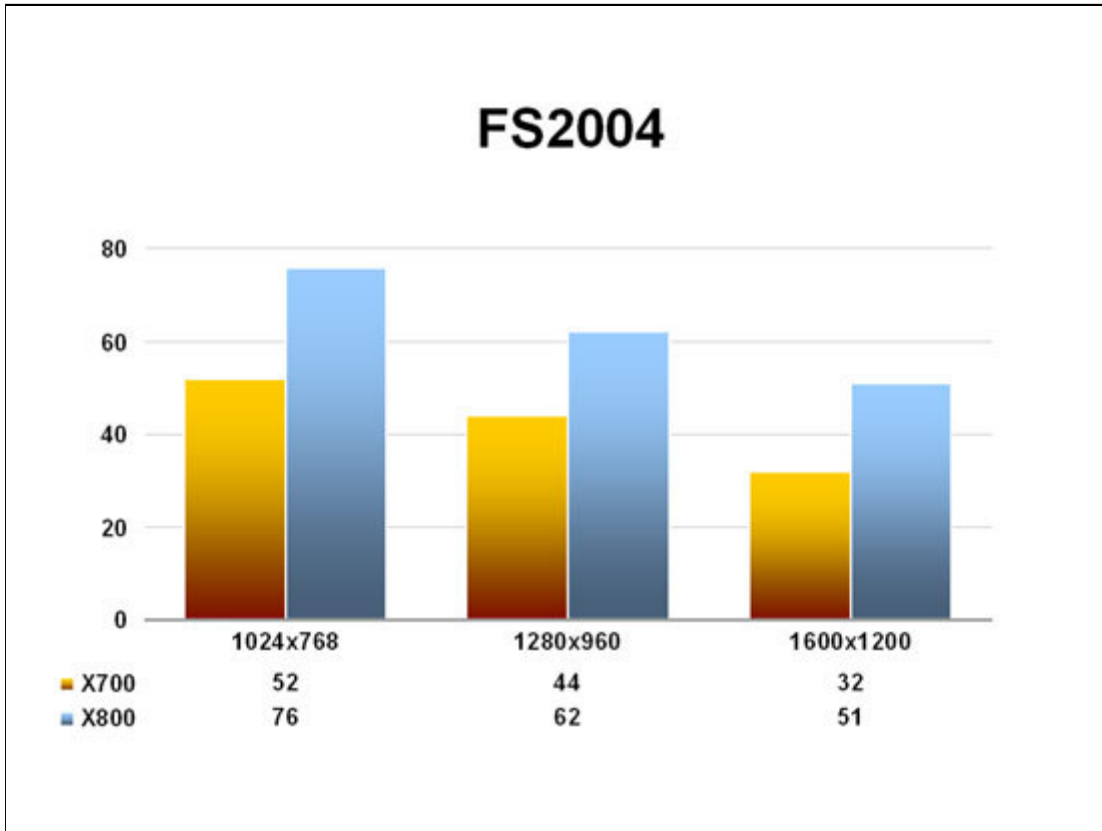
For comparison purposes a Radeon X800 XT is also included to allow an analysis of how each title in the test suite is or isn't affected by the significant performance differences of the two boards. And with this in mind, testing was conducted with in-game settings configured at higher, more demanding levels.

Lock On: Modern Air Combat was tested using the MiG-29 Intercept demo. In-game settings were at their highest options, except for several features such as water and heat bltr which were set to low and turned off. The demo was run for three minutes.



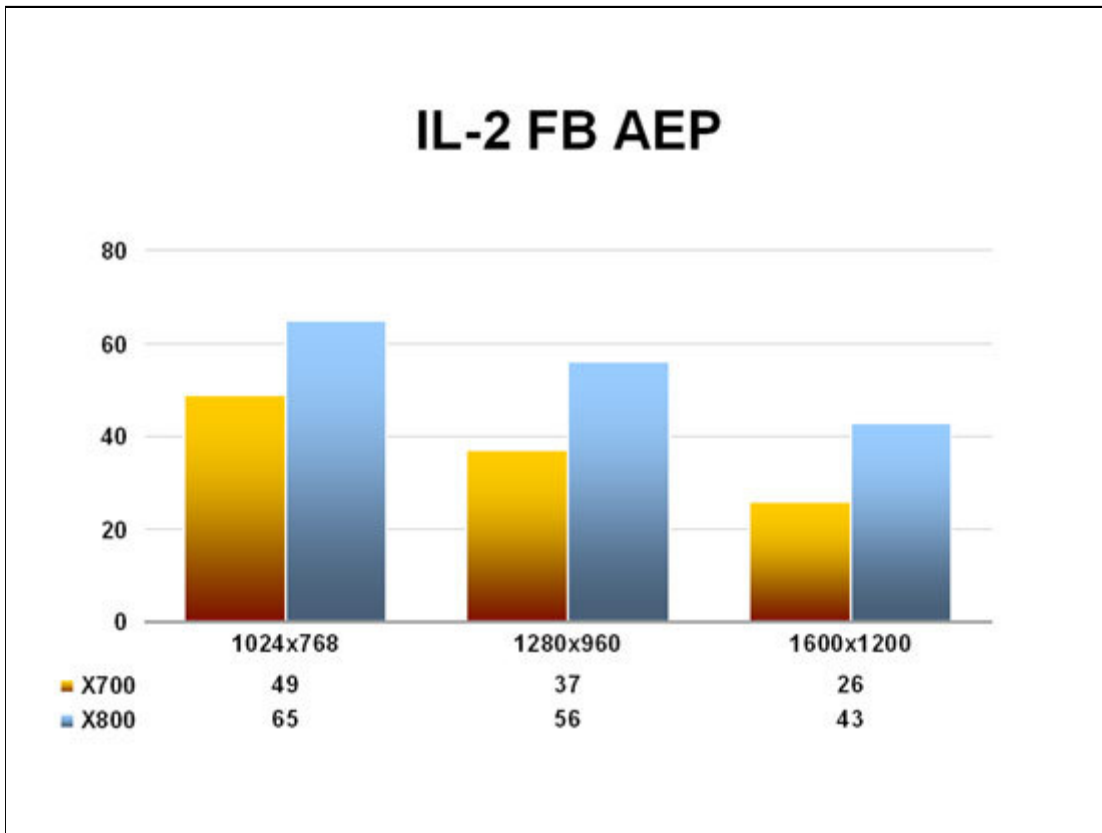
With LOMAC's graphics set at high the game is obviously unplayable at any of the resolutions, with the frame rate falling to roughly a third of what the X800 XT scored. Fans of this particular title shopping for a new graphics card at this price point will have to either spend more money or dial quite a number of the in-game options down a few notches.

Microsoft's **Flight Simulator 2004** was tested using SimHQ's in-house dusk flight over the city of Hong Kong, with an external camera view set behind the plane. Frame rate recording is stopped once the plane lands. MS: 2004 was configured with ultra high settings across its four hardware panels.



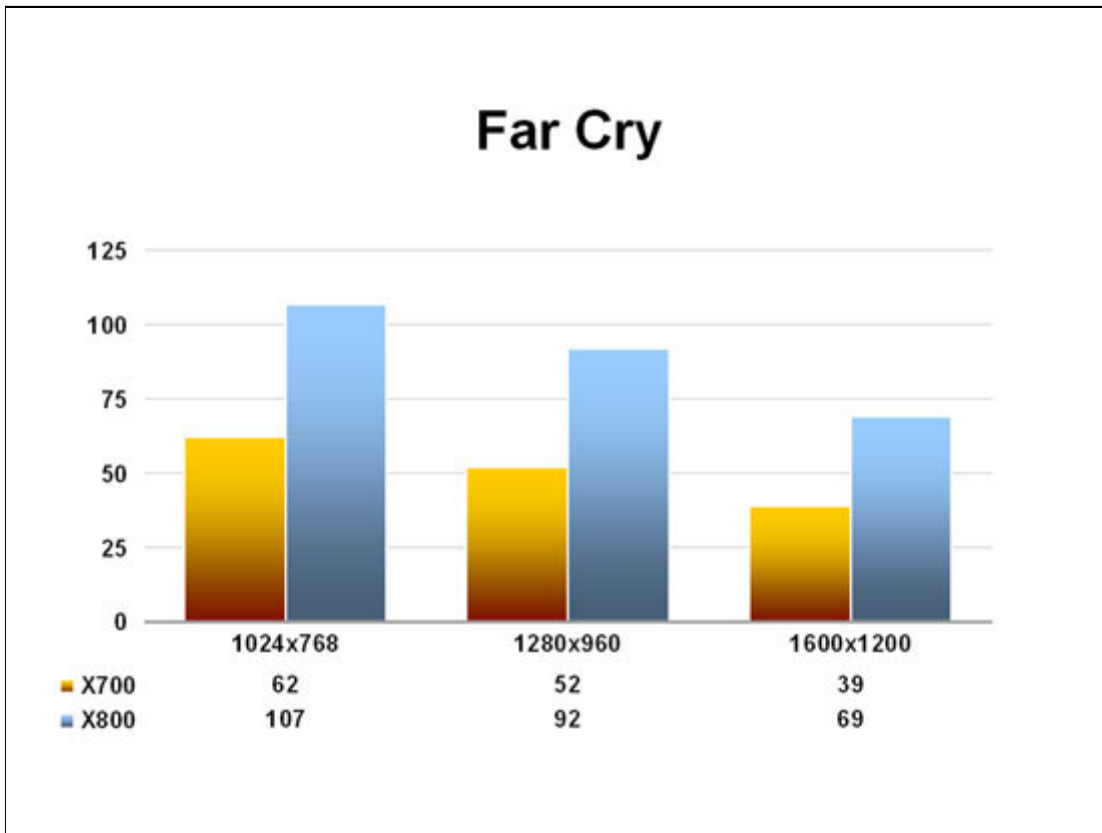
The X700 XT scaled well with the resolution changes and remained surprisingly playable at even 1600x1200, with the frame rate staying close to two-thirds that of the faster card.

IL-2: Forgotten Battles - Aces Expansion Pack represents SimHQ's non-modern flight simulation test. Using OpenGL, the landscape option was set to perfect and all other graphics options were at their highest settings. Testing consisted of using the Black Death track. SimHQ plans to incorporate the latest IL-2 release, Pacific Fighters, into our benchmark suite in the near future.



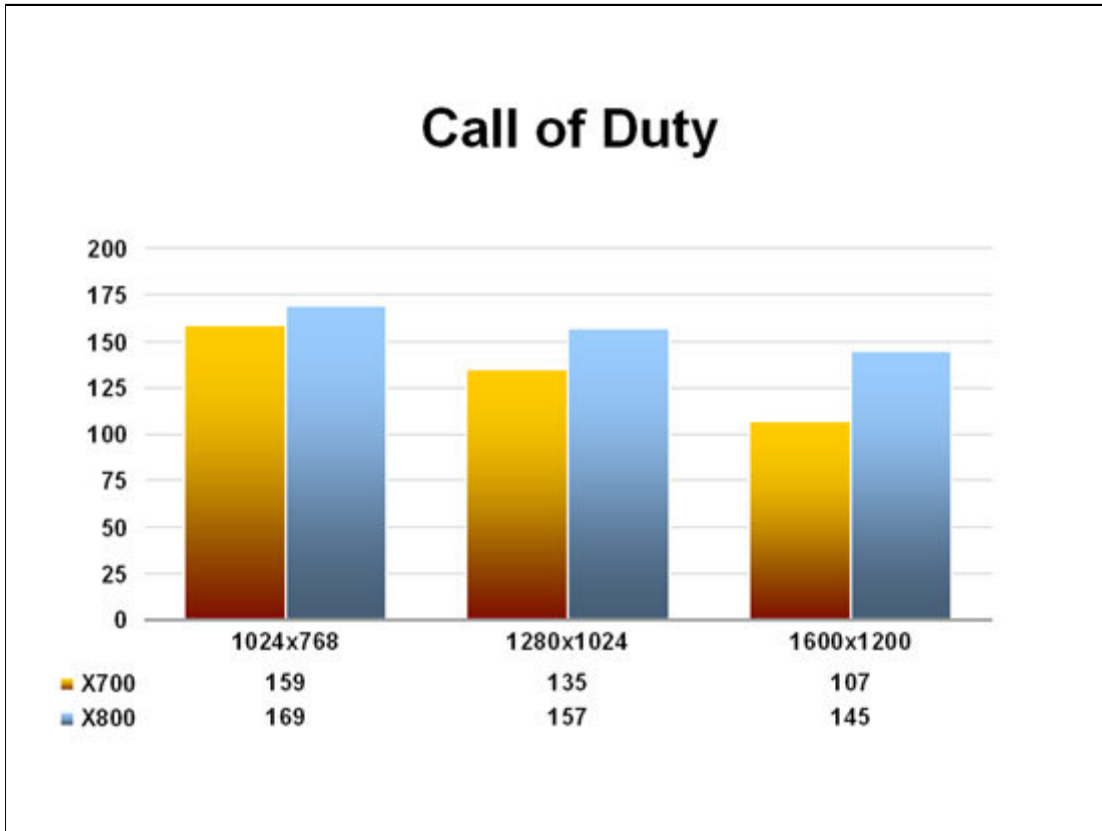
IL-2:FB-AEP is another title that turns in respectable scores while running on this mainstream board, though the lower fill-rate of the X700 board takes its toll at the higher resolutions, showing a sharper frame rate drop than the X800 displayed. The game, however, might still be playable for some even at the highest resolution tested.

Far Cry benchmark numbers are generated by repeated playings of the Research map, which consists of a good mix of beach, jungle, and interior settings found throughout the game's various levels. Fraps is used to record performance as the same path is taken through the map during each test and all in-game options were configured for their highest settings (water at ultra high).



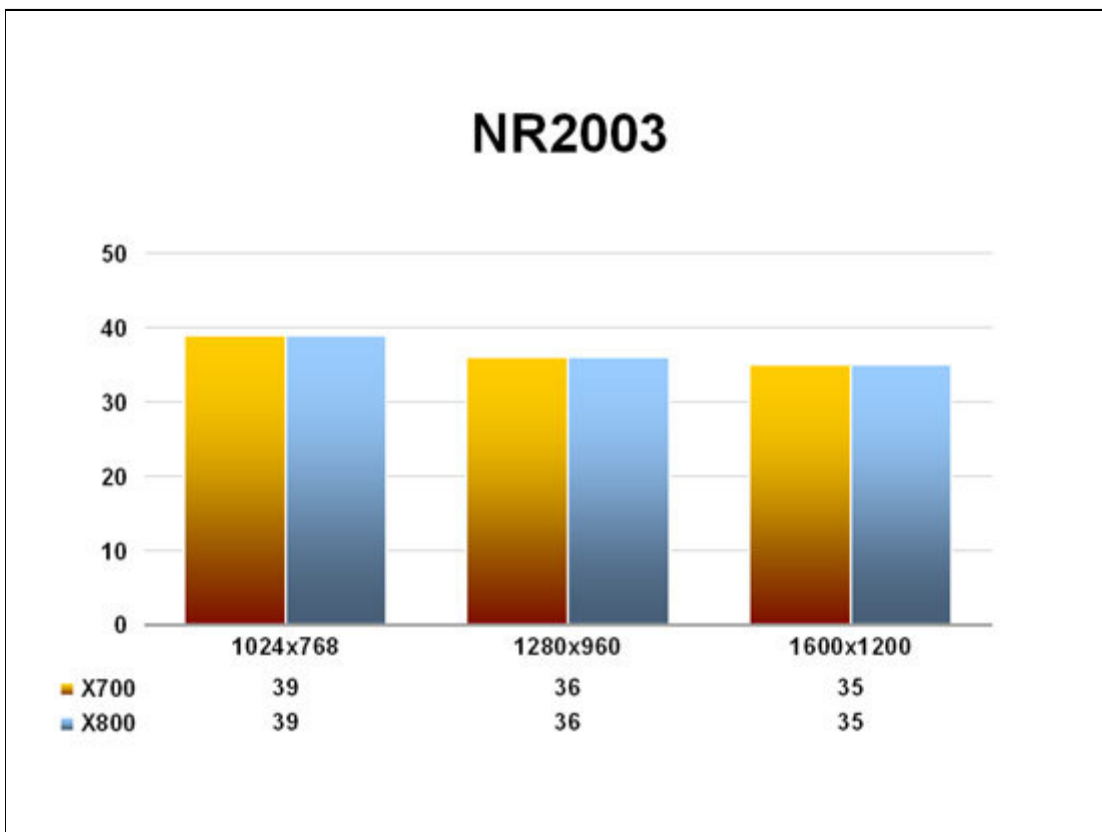
The X700 XT hung tough again, keeping the frame rate at a playable number throughout testing. While the X800 XT scores considerably higher its greater fill-rate and bandwidth doesn't allow it to outperform the slower card as much as one might expect.

Call of Duty is the second title SimHQ uses testing OpenGL rather than the D3D API. Scores were derived from the Dawnville demo using the in-game timedemo utility to capture performance. The "com_maxfps" console command was also used to lift the default frame rate cap of 85.



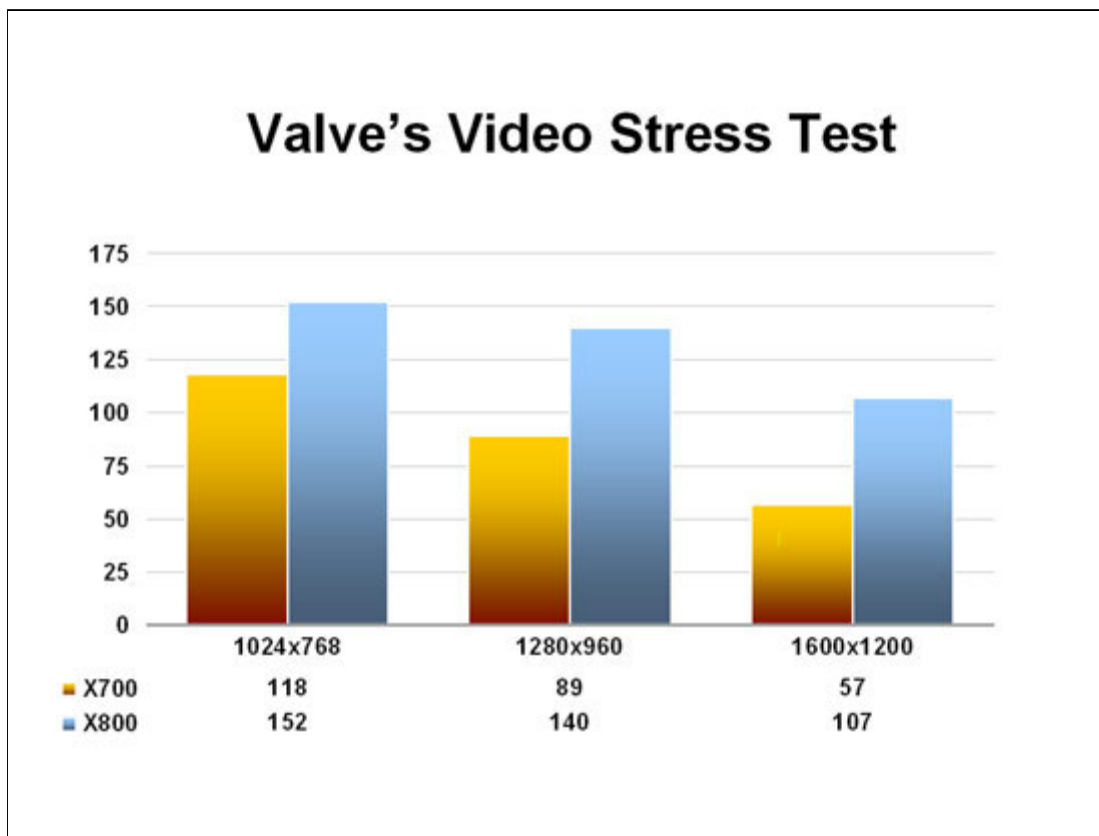
Games built upon the aging Quake 3 engine aren't much of a challenge to new hardware these days, even for mainstream budget cards, and the X700 pulls triple digit frame rates even at 1600x1200. It obviously begins hitting its fill-rate limits at the higher resolution as the frame rate drops considerably lower than the X800's score.

NASCAR Racing 2003 Season was tested using SimHQ's in-house replay, which consists of a crowded Daytona track with the camera view set to Earnhardt's cockpit. All graphics options were placed at their highest settings.



This particular title proves once again that its performance is entirely dependent upon the speed of the CPU it's running on. SimHQ is looking to retire NR2003 from its benchmark suite in the near future and replace it with SimBin's **GTR**.

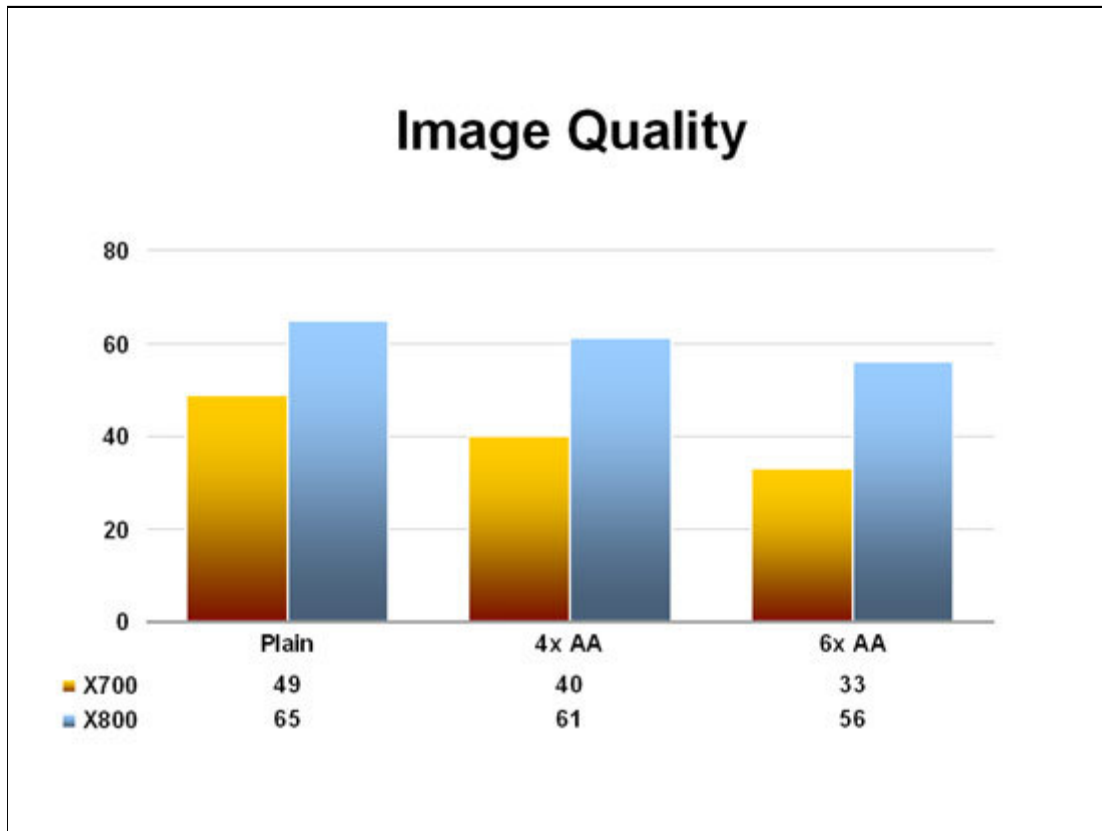
Valve's Video Stress Test is a utility now included with the new Source engine-based version of Counter-Strike. The Video Stress test itself is a fly-by of a relatively small custom level and is designed to show off numerous graphical effects rendered through the heavy use of various shaders.



While the X800 loses roughly a third of its frame rate as the resolutions were increased, the X700 drops by more than half. One has to wonder if the 128 MB of on-board RAM was inadequate for the frame buffer size and textures the test requires. Regardless, the card still managed a solid frame rate of 57 at 1600x1200.

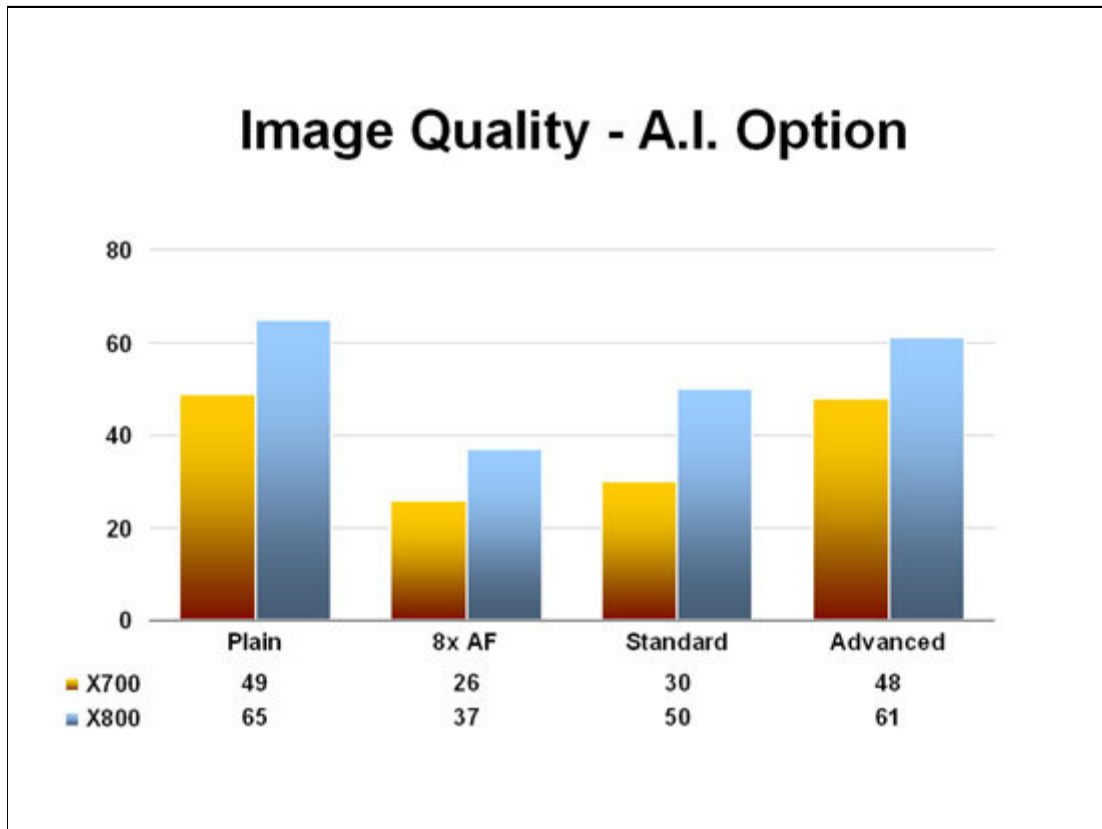
Image Quality

As a derivative of the R420 architecture, the X700s also support programmable multisampling modes of anti-aliasing. A sparse sampling pattern is defaulted to when the feature is enabled via ATI's driver panel, identical to that of the X800s. And temporal AA, the changing of the sampling pattern used each frame, is also supported by the X700s. Anti-aliasing performance is tested using IL-2: Forgotten Battles-Aces' Black Death track at the resolution of 1024x768.



While the X800 loses less than 10% once 4x AA was enabled, the X700 lost slightly over 20%, a result most likely caused by the memory bandwidth difference between the two boards. This trend continues with 6x also, with the slower board losing 30% of its performance, a much worse score than what the X800 exhibited. Gamers interested in using anti-aliasing may need to bear in mind the greatly reduced bandwidth mainstream cards such as the X700 ship with.

As explained in the X800 XT review, the ATI's A.I. option enables an adaptive filtering algorithm that examines the scene being rendered and attempts to filter with a emphasis on performance. When set at low A.I. enables all title-specific optimizations that ATI has built into the Catalyst drivers, while at high the adaptive filtering is applied more aggressively. Both A.I. and anisotropic filtering are tested below at 1024x768, again using IL-2: Forgotten Battles-Aces' Black Death track.



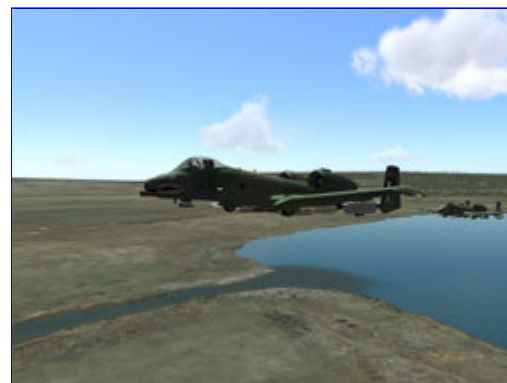
As usual IL-2: FB-Aces sees a tremendous frame rate drop with anisotropic filtering, with the X700 losing almost 50% of its performance. Enabling A.I. at its standard setting (formerly low), however, lends a much higher boost for the X800 than the X700, a peculiar situation since changing the setting to advanced (formerly high) brings the frame rate back up consistent between the two boards.

Gallery

All screenshots were captured at 1024x768 with 4x AA and 8x AF enabled using the licensed version of Fraps 2.3.3. Images are saved in the png format.



P-38 from IL-2:FB - AEP
(760 kb)



A-10 from LOMAC
(624 kb)

Conclusion

Using the latest Catalyst driver version, the X700 rendered every game thrown its way without issue and offered image quality identical to that of the high-end X800. Yet as a PCI Express only part, the X700 XT is clearly intended by ATI to

appeal to OEMs seeking a discrete add-in graphics board that is robust in its feature set and performance since the new bus hasn't had sufficient time to saturate the home market. Moreover, SimHQ would be somewhat remiss if we failed to mention that the noise level generated by the card's fan is most likely to be unacceptable to the typical home system builder, as its speed stepping is engaged almost immediately the moment a game is launched; the X700 is inarguably the loudest graphics card this reviewer has ever heard. ATI has perhaps been too aggressive with the clock speeds for the X700 XTs, and it will be interesting to see if board partners are able to improve the cooling solution for their offerings.

A recurring trend in the graphics market is that of current mainstream cards giving performance equal to, if not greater than, the previous year's high-end offerings, and the Radeon X700 XT certainly upholds that pattern. ATI has succeeded in essentially retiring the 9700 and 9800s from last year with their X700 lineup, as these new cards give all the features of the R420 architecture while boasting higher fill- and vertex rates thanks to the high clock speeds of the graphics chips. And for a board that comes with a suggested price of \$199, less than half the \$450 price tag of the X800 XT, the X700 XT exhibited remarkably good frame rates throughout most of SimHQ's current test suite — so long as the prospective buyer isn't particularly keen on combining anti-aliasing or anisotropic filtering and higher resolutions. Those looking to upgrade their aging graphics cards from years gone by without the financial burden of a second home mortgage should give the Radeon X700s consideration.