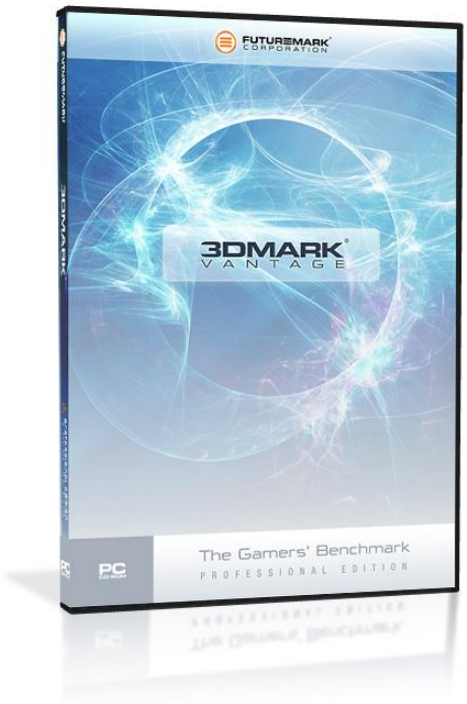
3DMark® Vantage

Reviewer's Guide v1.0

Dated: April 23rd, 2008



Product Name: 3DMark® Vantage

Product Version: 1.0.0

Product Tagline: The Gamer's Benchmark

About this Guide: This Reviewer's Guide is intended as the definitive reference on benchmarking PC platforms for gaming performance, using the latest industry standard benchmark for DirectX10-capable systems: 3DMark® Vantage. This guide assumes in places the use of the Professional Edition of 3DMark® Vantage.

Index

What's New with 3DMark® Vantage

3DMark® Vantage is the new industry standard PC gaming performance benchmark from Futuremark, newly designed for Windows Vista and DirectX10. It includes two new graphics tests, two new CPU tests, several new feature tests, and support for the latest hardware.

DirectX10

3DMark® Vantage is based on a completely new rendering engine, developed specifically to take full advantage of DirectX10, the new graphics API from Microsoft.

Completely New Tests

There are four main tests in 3DMark® Vantage, all completely new. The two graphics tests sport significantly advanced visuals, enabled by the new technology and performance available in the DirectX10 generation of graphics hardware.

The two CPU tests have been re-designed from scratch, and now feature a more complete spectrum of Physics and Artificial Intelligence-related computation. CPU Test 2 (the Physics Test) features support for physics acceleration hardware, and a workload to match future generation game physics.

Option Presets for a Wider Range of Official 3DMark® Scores

A key new feature in 3DMark® Vantage is the rendering option Presets. These pre-selected combinations of rendering option settings, like resolution, anti-aliasing and texture quality, represent different, successively more advanced levels of visual quality.

When running 3DMark® Vantage with one of the presets selected, the benchmark produces an official score for that preset. Instead of the single default setting of previous 3DMarks, there are four Presets available for Entry, Performance, High and Extreme visual quality. This gives four times the scope for comparing official results, and significantly better scaling for the benchmark.

System Requirements to run 3DMark® Vantage

The minimum hardware and software requirements and recommendations are:

- Processor
  - Requirement: SSE2 support
  - Recommendation: A dual-core processor with performance equivalent to Intel Core 2 Duo E6600, AMD Athlon X2 6000+, or higher
- Graphics Card
  - Requirement: Fully DirectX10-compliant graphics hardware
- Display Device
  - Requirement: Capable of 1280x1024 resolution
  - Recommendation: Capable of 1920x1200 resolution
    - Needed to run all the presets
- System Memory
  - Requirement: Windows Vista minimum requirement
  - Recommendation: 2 GB or more
- Hard Disk
  - Requirement: 1 GB of free hard disk space
- Operating System
  - Requirement: Windows Vista with Service Pack 1

To confirm whether your system is capable of running 3DMark® Vantage, please visit the following page for a quick online system compatibility analysis: http://www.yougamers.com/gameometer/10171

Testing Guidelines

Please follow the recommended testing procedure below to get accurate and repeatable benchmark results in a typical 3DMark® Vantage use case. Deviating from this recommended testing procedure is acceptable when 3DMark® Vantage is being used to fulfil specific custom benchmarking needs. Please note that customized testing procedures may not produce results which are comparable with results produced using the recommended testing procedure. The exact custom testing procedure needs to be documented and published alongside the results if any such custom results are being reported, published or otherwise communicated. These testing guidelines may be updated from time to time.

Recommended Testing Procedure

Set-up

In order to prepare a target system for testing, the following steps are recommended:

1. Install the latest approved drivers for the target hardware. A list of approved drivers can be found on the product website, http://www.futuremark.com/products/3dmarkvantage/.
2. Install and register 3DMark® Vantage
3. Install all critical system updates to ensure your operating system is up to date.

Testing

1. Restart the computer before running the benchmarks.
2. Wait for 60 seconds.
3. Exit all other programs[1].
4. Wait for 15 minutes.
5. Run the benchmark.
6. Repeat from step 1 at least three times to verify that the results are reproducible.

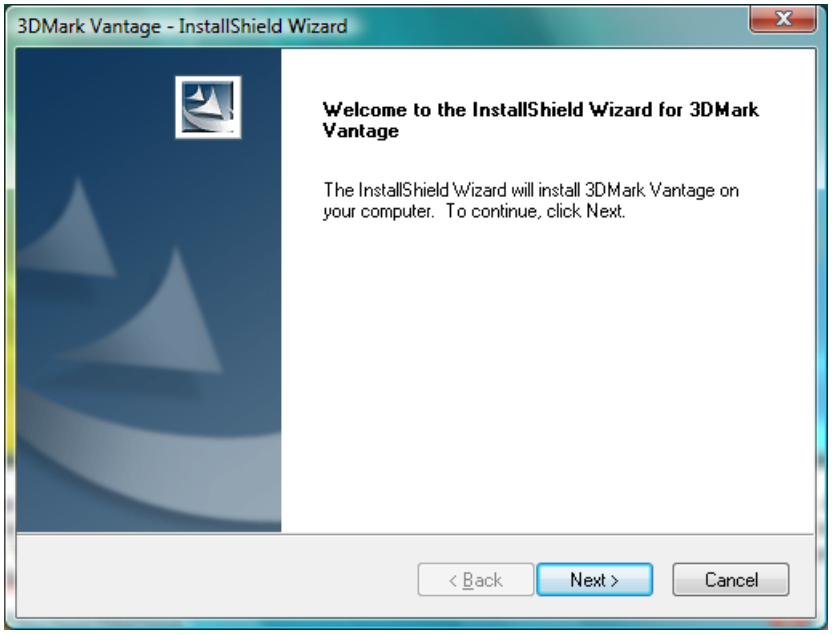
Additional Recommendations for Testing

- We recommend testing only "clean" systems that have no 3rd party software installed, since 3rd party applications and services may affect the results.

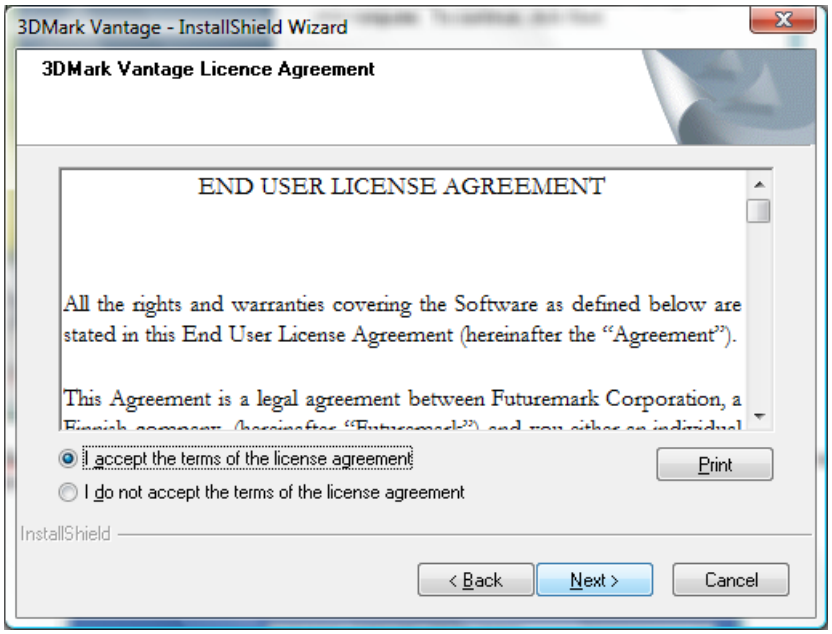
[1] Under the Windows Vista operating system, other tasks can pre-emptively run during the tests, thus affecting the results. You will want to eliminate as many of these types of tasks as possible, such as automatic updates in operating systems, e-mail clients or other tasks from your *Startup* folder. This action also maximizes available system memory.

Installing 3DMark® Vantage

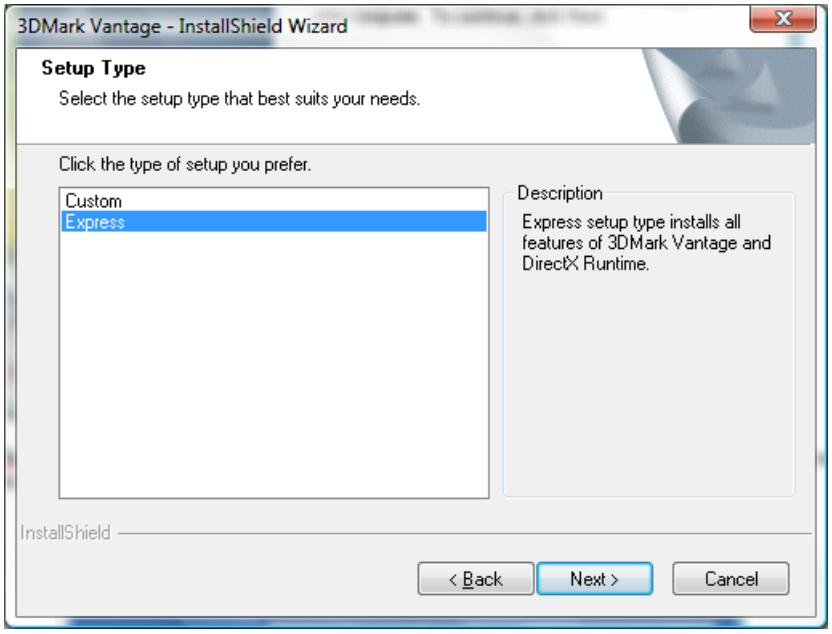
1. Start the 3DMark_Vantage_v100_installer.exe installer by double-clicking on it.
2. The installer requires administrator privileges in order to set up required files in protected folders. If the installer requests privilege elevation, please accept and continue.
3. You will be taken to the welcome screen for the installer. Just click “Next”:



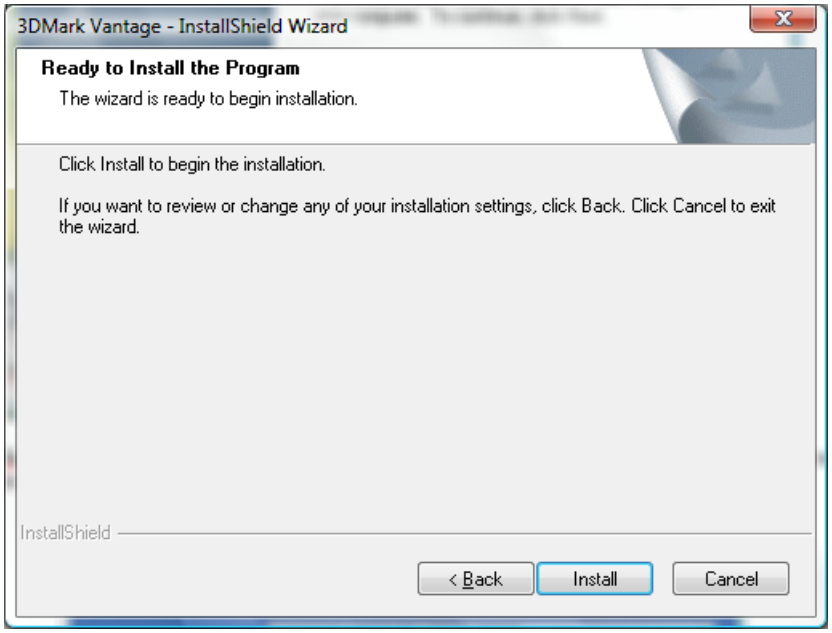
4. Please read through the end user license agreement for 3DMark® Vantage and Microsoft DirectX runtime. If you wish to continue installing the product, select “I accept the terms of the license agreement” and click on “Next”.



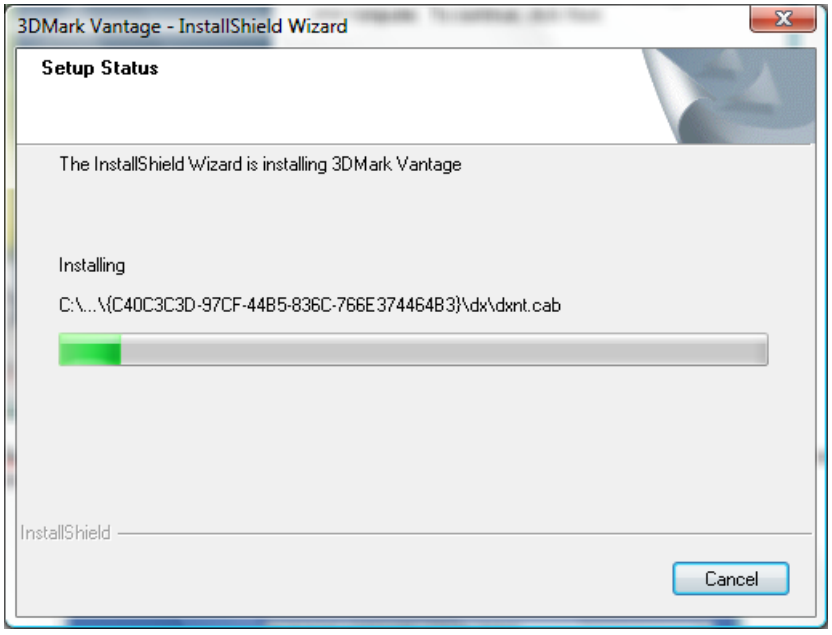
5. Select “Express” setup for easy installation into the default location. This will install all the required software, including a DirectX runtime, and physics card drivers. Click “Next”.



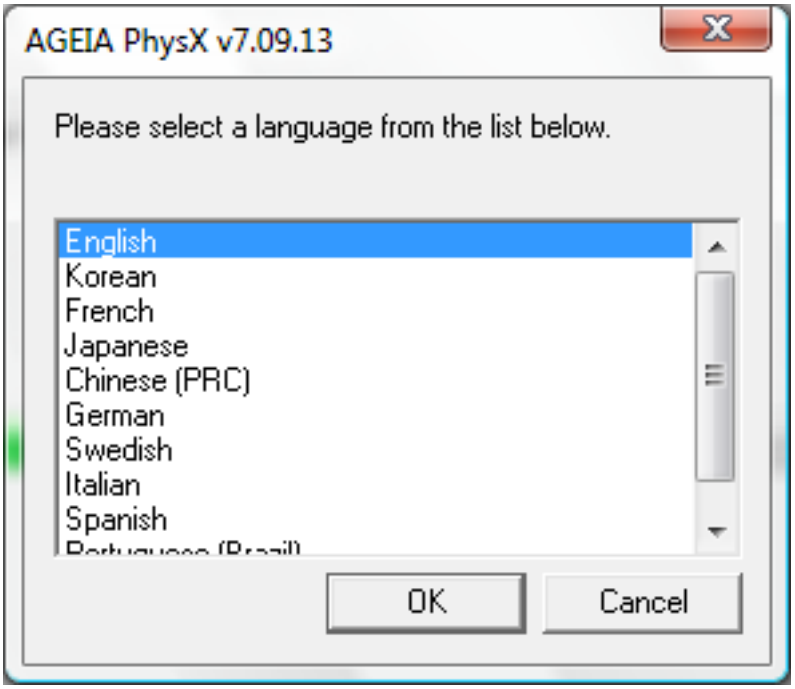
6. The installer will present a confirmation dialog. Click on “Install” to begin the installation.



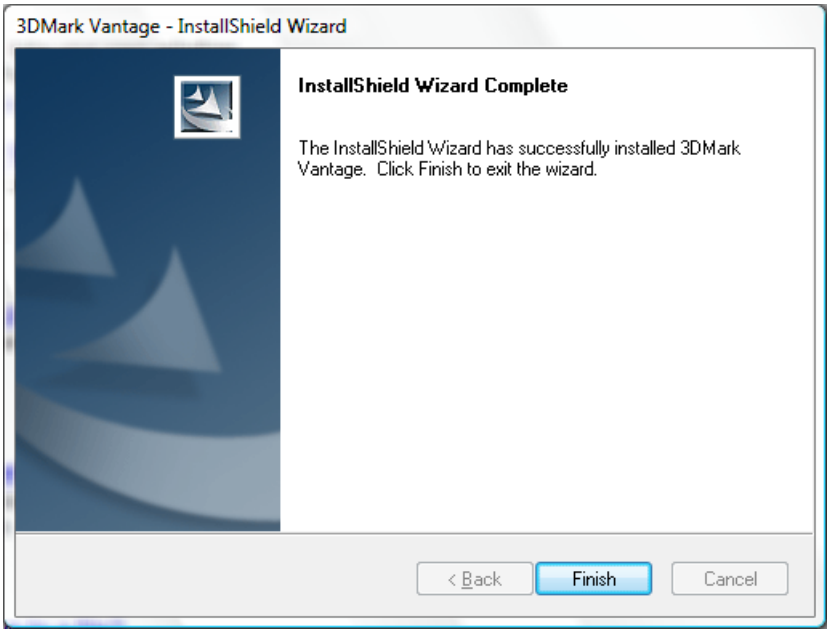
7. Installing the files may take several minutes, depending on your system.



8. During the installation, you will be asked to select a language for the physics card driver installation. Select the language most suitable to you, and click OK. The installation will continue.



9. When the installation is completed, you will see a completion dialog. Click on “Finish.”



10. You are now ready to start using 3DMark® Vantage.

Registering 3DMark® Vantage

1. Double-click the 3DMark® Vantage icon on your desktop to start the application. The installer will have automatically created a desktop icon for you if you selected “Express” set-up.
2. Enter the registration key in the appropriate field on the registration page. You can cut and paste the registration code directly from the Futuremark email, to avoid typing errors:

3. If the registration code is valid, you will be taken directly to the application main screen. If there is a problem with the registration code, please make sure the spelling is correct and try again.

Running the 3DMark® Vantage Test Suite

To run the entire test suite, just click on the “Run Benchmark” button in the “Main” tab of the 3DMark® Vantage application:

In the professional edition, this will run two graphics tests, two CPU tests, and six feature tests. The tests may take several minutes to run, depending on your system performance.

When running the tests, do not touch the mouse or keyboard. Specifically, do not change the window focus away from the benchmark application. Doing so will abort the benchmark and invalidate the score.

If you want to abort the test run, press Esc on the keyboard at any time, and wait for the test suite to shut down, and return you to the application’s main user interface.

Viewing and Interpreting Results

When you have run the test suite, you are taken to the results view:

The 3DMark® Score is shown at the top left, prefixed with the letter code for the selected rendering option Preset (P for the Performance Preset in the example). Directly below the main 3DMark® Score are the sub-scores: the GPU Score and the CPU Score. The right side of the results screen is taken up by the raw scores for each test.

The 3DMark® Score and Sub-scores

The 3DMark® Score represents the overall gaming performance of the tested system. Both the GPU and the CPU performance are reflected in the score. The GPU Score and CPU Score are called the sub-scores; they represent the performance of the GPU and CPU, respectively.

The 3DMark® Score is formed by taking a weighted harmonic mean of the sub-scores. The GPU Score is formed by taking a weighted arithmetic mean of the raw scores of the two graphics tests. The CPU score is formed by taking a weighted arithmetic mean of the raw scores of the two CPU tests.

The 3DMark® Score is calculated slightly differently for each Preset. The higher Presets give a higher weight to the GPU Score. This means that the 3DMark® Scores are not comparable across different Presets. Rather, they represent overall performance in a specific performance category defined by the Preset. For example, the Entry Preset scores represent performance at entry-level graphics load, and should not be compared with Performance, High or Extreme Preset scores.

The sub-scores are comparable across presets, since they are calculated identically, regardless of the Preset. GPU Scores for the higher presets typically have lower values since the graphics load is significantly increased. CPU Scores are not affected by Presets, since the Preset rendering options only affect the graphics test.

Please see the 3DMark® Vantage whitepaper for score formula details and the specific weights used in the calculations.

The Raw Test-specific Scores

Each test reports a raw score. The score units vary from test to test, but they are all expressed as rates (1/second). The main graphics tests report results as frame rates (frames per second, FPS). The CPU tests measure operation rates: path-finding tasks processed per second for the AI Test, and physics steps simulated per second for the Physics Test.

The raw test scores may be used in analyzing the impact of the different rendering Presets and custom options on the main graphics tests. They are also needed to analyze feature test performance. The two CPU tests are also so different from each other, that looking at the test-specific scores may reveal important in-depth information on the CPU performance of the tested system.

Please see the 3DMark® Vantage whitepaper for detailed information on the measurement of the test-specific scores, and their units.

Presets

A key new feature in 3DMark® Vantage is the introduction of rendering option Presets. Instead of the single default setting of previous 3DMarks, there are now four option Presets to choose from, each yielding an official 3DMark score. You can easily select a preset setting from the drop-down menu available at the top of the Main and all Options screens.

Preset Composition

The four Presets are Entry, Performance, High and Extreme, and they form a series of increasing visual quality with a corresponding increase in graphics load. The presets affect only the two main graphics tests, Jane Nash and New Calico. The CPU tests and the Feature Tests are un-affected by the Presets. Please see the 3DMark® Vantage whitepaper for detailed information on the option values selected for each Preset.

Preset Scores

Each Preset gives an official 3DMark® score. The scores are different for each Preset and not directly comparable across Presets. For example, running the test suite using the Entry preset yields an Entry 3DMark® Score, denoted by the letter E pre-pended to the score reading. The preset code letters and example scores are given in the following table:

Preset	Code Letter	Example Score
Entry	E	E7053
Performance	P	P5420
High	H	H3207
Extreme	X	X2641

The scores for different Presets are not directly comparable with each other. Each Preset weighs the graphics and CPU sub-scores differently, with the higher presets emphasizing graphics performance increasingly heavily. For details on the score calculations for each preset, please refer to the 3DMark® Vantage whitepaper.

The Graphics Tests

There are two graphics tests in 3DMark® Vantage: Jane Nash (Graphics Test 1) and New Calico (Graphics Test 2). The Jane Nash test scene represents a large indoor game scene with complex character rigs, physical GPU simulations, multiple dynamic lights, and complex surface lighting models. It uses several hierarchical rendering steps, including for water reflection and refraction, and physics simulation collision map rendering.

The New Calico test scene represents a vast space scene with lots of moving but rigid objects and special content like a huge planet and a dense asteroid belt.

For details on the graphics test contents and workload, please refer to the 3DMark Vantage whitepaper.

Graphics Test 1: Jane Nash

The following features are specific to this scene:

- Lots of static objects
- Lots of complex dynamic skinned objects
- Cascaded shadow maps using PCF filtering
- Very few instanced objects
- No ray-marching (volumetric) effects
- Cloth simulation
- Anisotropic materials (math-heavy)
- Caustics
- Hierarchical rendering passes to render water reflection and refraction

When interpreting the results of a benchmark run, it is useful to refer to this list of features, as they have a direct influence on the test performance.

Graphics Test 2: New Calico

The following features are specific to this scene:

- Almost entirely consists of moving objects
- No skinned objects
- Variance shadow mapping shadows
- Lots of instanced objects
- Local and global ray-tracing effects (Parallax Occlusion Mapping, True Impostors and volumetric fog)

When interpreting the results of a benchmark run, it is useful to refer to this list of features, as they have a direct influence on the test performance.

The CPU Tests

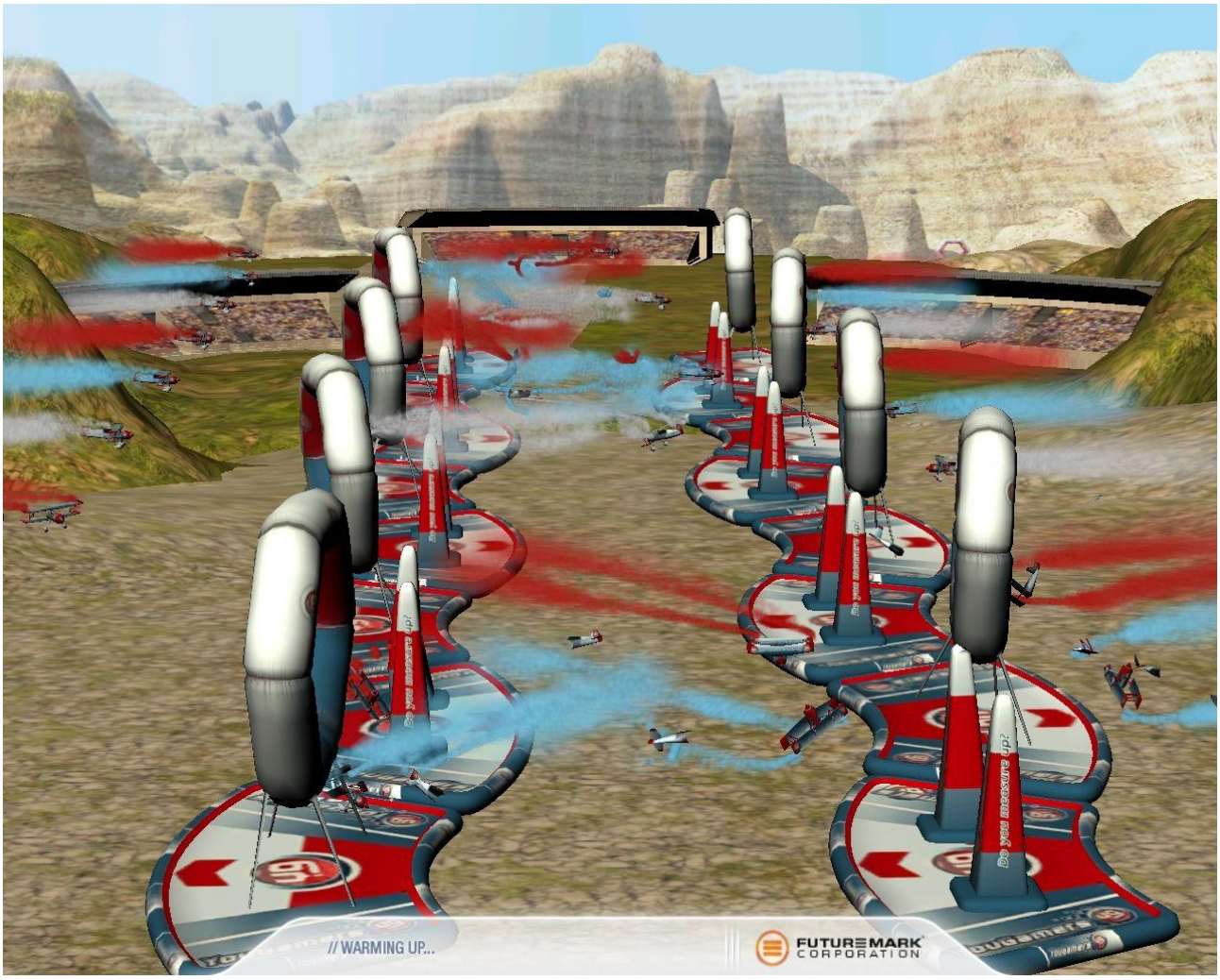
CPU Test 1: AI

The AI test features a high-intensity workload of co-operative manoeuvring and path-finding artificial intelligence calculations. The test setting is an airplane race course crowded with planes, all attempting to navigate through a series of gates while avoiding collisions with each other and the ground.

The test load consists of the movement planning for each airplane. The workload is entirely parallelized, and can utilize multi-core CPUs to the fullest. Faster CPUs will be able to compute more frequent and timely movement plans for the airplanes, resulting in smarter flight routes.

CPU Test 2: Physics

The Physics Test features a heavy workload of future generation game physics computations. The scene is set at an air race, but with an unfortunately dangerous configuration of gates. Planes trailing smoke collide with various cloth and soft-body obstacles, each other, and the ground. The smoke spreads, and reacts to the planes passing through it.



The physics test takes advantage of the AGEIA PhysX physics accelerator, if found on the system.

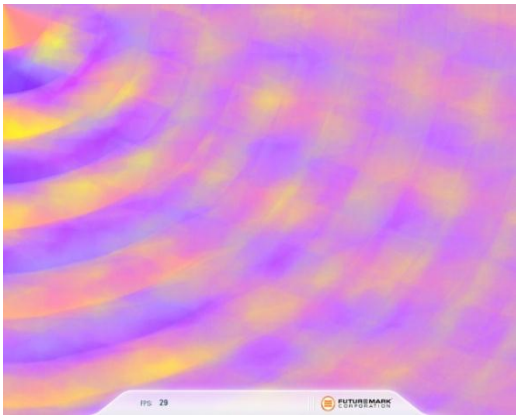
The Feature Tests

There are six feature tests in 3DMark® Vantage. Each isolates a specific set of graphics hardware functionality, and exercises it to the limit. In contrast to the main graphics tests with their large range of effects, techniques and content, the feature tests let you focus your testing on specific capabilities of the target hardware. The feature tests do not contribute to the main 3DMark® score.

You can select feature tests to include in a test run by clicking on them in the Feature Tests screen of the Options panel:

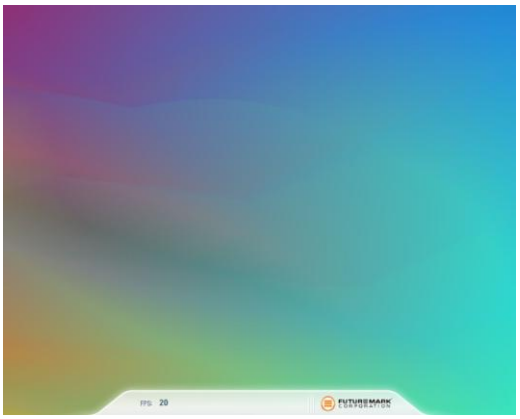
The rendering option Presets do not affect the feature tests.

Feature Test 1: Texture Fill



This test draws frames by filling the screen rectangle with values read from a tiny texture using multiple texture coordinates. The texture coordinates are rotated and scaled between each frame.

Feature Test 2: Color Fill



This test draws frames by drawing a rectangle across the screen multiple times. The color and alpha channels of each corner of the rectangle is animated. The pixel shader is pass-through. The interpolated color is written directly to the render target using alpha blending. The render target is in 16-bit floating-point format, currently the most relevant format for HDR rendering output.

Feature Test 3: Parallax Occlusion Mapping (Complex Pixel Shader)

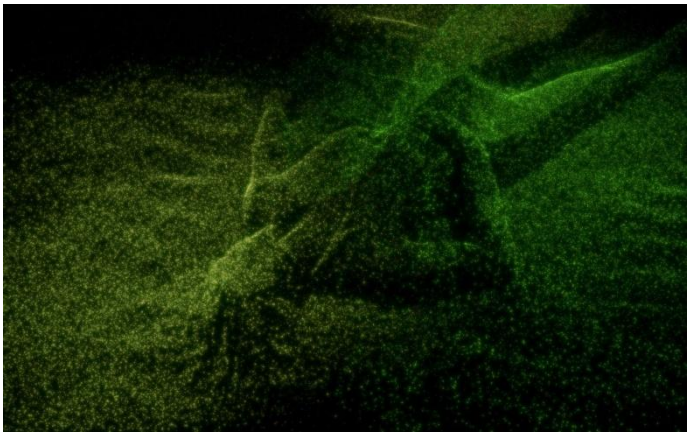
This test draws frames by rendering a single rectangle (two triangles) on screen, seen from an animated camera position. The pixel shader uses the Parallax Occlusion Mapping technique to simulate complex geometry under the surface of the rectangle. Heavy ray-tracing operations against a huge depth-map determine the actual intersection of the view ray with the geometry. Further ray-tracing determines visibility of that point from multiple animated light sources. Finally, the surface is shaded using the relatively complex Strauss shading model.

This test represents a very complex, heavy pixel shader, containing massive amounts of texture reads (ray-tracing) and dynamic flow-control (ray-tracing, looping over multiple lights), as well as traditional lighting calculations (Strauss). All the geometry on screen is rendered on just two triangles, and simulated entirely in the pixel shader.

Feature Test 4: GPU Cloth

This test features physical simulation of cloth on the GPU. The simulation is performed as a vertex simulation using a combination of vertex shader and geometry shader stages, with several simulation passes needed for each simulation step. Stream out is used to cycle the cloth vertices from one simulation pass to the next. This test stresses the vertex shading, geometry shading and stream out features of the hardware.

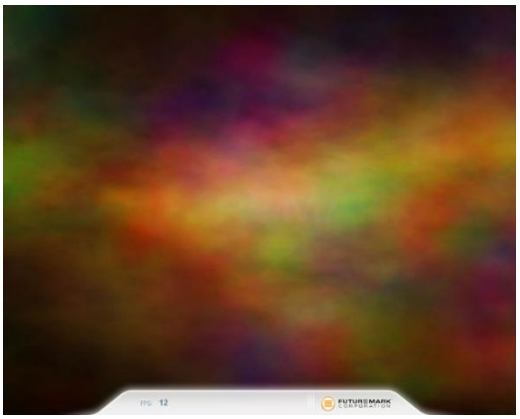
Feature Test 5: GPU Particles



This test features physically simulated particle effects on the GPU. The simulation is performed as a vertex simulation, with each vertex representing a single particle. Stream out is used to cycle the particle vertices from one simulation pass to the next.

There are hundreds of thousands of particles in the test, all individually simulated, and colliding with a height map. The particles are rendered by expanding each vertex to a full rectangle in the geometry shader. The test stresses the vertex shading, stream out.

Feature Test 6: Perlin Noise (Math-heavy Pixel Shader)



This test features multiple octaves of Perlin noise evaluated in the pixel shader. Each color channel has its own noise function for added computational load. The Perlin noise function is a standard building block of procedural texturing approaches, and is very math-intensive to compute in a pixel-shader. This feature test emphasizes the arithmetic computing power of the graphics hardware.

Advanced Test Options

The Test Options screen provides a variety of test options, most of which control the rendering engine:

Rendering Options

Please see the 3DMark® Vantage whitepaper for detailed information on each of the rendering options.

The "Disable PPU" Option

On systems with a Physics Processing Unit present, the Physics Test (CPU Test 2) is normally run using the PPU hardware for acceleration. To compare test results on the same system without using the PPU, you can turn on the "Disable PPU" option. While this option is enabled, the PPU will not be used to accelerate the physics test.

This is the only option you can modify without forcing a Custom preset. Benchmark results obtained using any of the four options presets, but with this option turned on, will still produce be valid scores for that preset.

The "Flush on Low FPS" Option

Sometimes test performance on some hardware is so slow that the operating system triggers a Timeout Detection and Recovery error (TDR), forcing the test to abort in the middle. This will typically only ever happen on FPS rates of 2 or below. Feeding certain flush operations to the graphics hardware during these very slow frames may help prevent the TDR from occurring, and enables the user to run the test timeline until the end.

This option severely degrades the reliability and usefulness of the scores produced, and should never be used when seeking reliable performance measurement results. At particular risk are multi-GPU systems, whose performance may be seriously misrepresented if this option is turned on. This option is provided solely to enable even low-performance parts to view all the tests.

Creating, Running and Analyzing a Custom Preset

For truly in-depth benchmarking, use a Custom preset. To start using a Custom preset, change any of the options on the Test Options tab in the Options view. You can easily differentiate your analysis of the target hardware by drilling down on one or more of the rendering settings, and analyzing the comparative results.

The key to using Custom settings in analysis are the sub-scores and the test-specific raw scores. Since no main 3DMark score is produced when using a Custom preset, you need to first look at the Graphics sub-score for the impact of the option changes. The sub-scores are comparable between presets, and also between any Preset and a custom setting. Test-specific scores are also comparable regardless of the Presets.

Automating Testing with the Command-Line Interface

The Professional Edition of 3DMark® Vantage provides a command-line interface to running the benchmark. The command-line interface accepts text-based configuration files for specifying custom or Preset-based test runs, and outputs test scores into an easily machine-readable text file with comma-separated result values.

The command-line interface resides in the installation target folder. Typically, this is *C:\Program Files\Futuremark\3DMark Vantage*. The executable is named *3DMarkVantageCmd.exe*. There is an example configuration file provided, as well as configuration files for a test run for each preset. Please use the example configuration file as a starting point for creating your own custom test runs.

3DMark® Vantage System Info

3DMark® Vantage comes installed with Futuremark SystemInfo, the premier system information module for the PC. You can access your system information from the System Info screen, by clicking on the View System Info button:

After a scan of your system, you will be presented with a detailed information sheet of your system internals. The scan may take up to several minutes, depending on your system configuration and performance.

3DMark® Vantage Reference Information and Details

A Benchmarking First with Microsoft DirectX 10

3DMark® Vantage is the first comprehensive benchmark application based exclusively on Microsoft's latest DirectX 10 API and thus takes full advantage of the features provided by the current generation of graphics hardware, including Multi-GPU configurations and multi-core CPUs. Over the years, many generations of Futuremark's 3DMark® benchmark applications have provided valuable first insights into the performance and visual advances made possible by new and improved DirectX API versions and graphics hardware.

Tracking and comparing results with the ORB

3DMark® Vantage's comprehensive online result analysis tools provide honest insight into the performance of your computer. The ORB allows users to upload, store and compare their test results, scores, and system info to do multiple comparisons, access detailed system info, use dynamic compare URLs and even compare uploaded systems to other user systems in the database. The ORB helps every benchmark user to gain up-to-date information on how their current computer system stacks up with the latest system configurations available and which hardware upgrades would provide the best price/performance ratio for their particular system configuration.

Developed in partnership with leading PC industry hardware manufacturers

Futuremark is known throughout the IT industry for producing well designed, unbiased and impartial benchmarks based on real-world, next generation workloads and 3DMark Vantage exemplifies that reputation. Developed in conjunction with our Benchmark Development Program members, this latest offering from Futuremark is a collaborative effort that builds on the expertise of not only Futuremark but all of the development partners as well.

3DMark® Vantage Editions, Pricing and Availability

There are three editions of 3DMark® Vantage available: The Basic, Advanced and Professional Editions.

Due to the increased amount of work necessary to create a benchmark for Windows Vista OS which has required new software engines, tooling and artwork as well as an increased level of web services and analysis tools, offered to the benchmarking consumers, we have had to change our pricing strategy for 3DMark® Vantage. A no cost option is still available in the form of a one-time use trial of the Basic Edition.

The trial version will deliver a 3DMark Vantage score and allow for submission of a result into the Online Results Browser, but, will require upgrading to the Basic Version for benchmarkers who want to use it for an unlimited number of runs. This can be done by simply entering in the correct registration code for the basic version without requiring an additional download.

The differences between 3DMark Vantage Basic, Advanced and Professional editions are as follows:

The 3DMark(R) Vantage Basic Edition ($6.95) (Download Price)

- Unlimited number of test runs using a single Preset setting
- Network connection required to view results
- Licensed for non-commercial and Personal Use only

The 3DMark(R) Vantage Advanced Edition ($19.95) (Download Price)

- Unlimited testing, access to all Presets and custom settings
- Network connection required to view results
- Licensed for non-commercial and Personal Use only

3DMark Vantage Professional (this is the Edition for Press)

- $495.00/seat (download or CD-ROM)
- All Advanced version features
- Technical support
- View results without network connection
- Benchmark automation with command line scripting
- Licensed for Full Commercial Use

Usage & Distribution Guidelines

These guidelines contain important information about using 3DMark® Vantage and publishing results. Please consult the guide below before using the software or publishing results. If you have any questions related to these matters, please contact us!

Publishing benchmark results

Only fully licensed, 3DMark® Vantage Professional Edition users may publish benchmark results in marketing materials or in any media or publication. Make sure that you follow instructions set forth in the license agreement and in our testing guidelines. Also, include the official 3DMark® Vantage logo with a link or referral to Futuremark. Logos can be downloaded here:

http://futuremark.com/companyinfo/pressroom/productlogos/

Preset scores

In order to keep the reported scores comparable, we highly recommend that you use one or more of the Preset settings as a reference point. Referring to the Presets will make comprehending the results easier for other users running 3DMark® Vantage on their systems.

Distribution guidelines

3DMark® Vantage or parts of it cannot be distributed without a specific written permission from Futuremark.

Please contact sales@futuremark.com for more details on how to obtain a PC media license of 3DMark® Vantage Professional.

Additional Information | Futuremark Contact Details

To read the 3DMark® Vantage White Paper, with detailed background, test methodology, market and development information; send your request via email to ollie@futuremark.com

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About Futuremark® Corporation

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