



NVIDIA Maximus Case Study

NVIDIA Maximus Helps Sony Pictures Imageworks Create Smoking Fast VFX for *Men in Black 3*

Sony Pictures Imageworks (SPI) has a long legacy of technical innovation tapping [NVIDIA® Quadro® professional GPUs](#) for feature film visual effects, ranging from *Cloudy with a Chance of Meatballs* to *Alice in Wonderland* and the *Spider Man* film franchise. For [Men in Black 3 \(MIB³\)](#) the company once again turned to NVIDIA technology to realize dramatic speed increases and visual effects workflow efficiencies.



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Smoke effects play a significant role in *MIB3* and are featured in almost all of the 600 visual effects shots created by SPI for the film, including a memorable rocket launch sequence from Cape Canaveral in Florida. Creating computer generated (CG) smoke is a very labor-intensive process, requiring complex simulations that tie up expensive and valuable computer processing power. Theo Vandernoot is an effects supervisor at SPI and a longtime user of both Side Effects' Houdini software and NVIDIA GPUs. He discovered that by using Houdini 12 (with improved GPU optimization) on an [NVIDIA Maximus™](#)-powered workstation, he could dramatically improve not only the speed of simulations by up to 10X, but also the quality of smoke generated in *MIB3*.

Multi-tasking with Maximus

Vandernoot started working on an NVIDIA Maximus workstation at around the same time that Side Effects Software released Houdini 12 with a new GPU-accelerated Navier-Stokes based smoke solver called Pyro FX2.

NVIDIA Maximus-powered workstations combine the visualization and interactive design capability of NVIDIA Quadro GPUs with the high-performance computing power of [NVIDIA Tesla® GPUs](#) into a single workstation. Tesla companion processors automatically perform the heavy lifting of photorealistic rendering or simulation computation. This frees up CPU resources for the work they are best suited for – I/O, running the operating system and multi-tasking – and also allows the Quadro GPU to power rich, full-performance, interactive operations on the system.

“With a Quadro and a Tesla card, I could offload all of the processing power required by the simulation onto the Tesla card. This allowed other tasks to be performed on the same workstation while the simulation was underway—anything from another project in Houdini to working in a compositing or lighting application,” explained Vandernoot. “With the addition of the Tesla card, you have a dedicated processing unit that is simply working on the simulation and nothing else.”

Staying on Task

Creating *MIB³* smoke simulations on a Maximus system proved to be so efficient and easy to drop into the pipeline, SPI deployed ten Maximus-powered workstations on the show. These workstations were put in place to support a tools pipeline that includes Side Effects Software Houdini 12 and Autodesk Maya, Arnold for rendering, and SPI’s Katana (now commercially available from The Foundry) for lighting.

“One of the most difficult issues when building simulations into your visual effects workflow is the mental turnaround time. It’s like painting in the dark. You make virtual brush strokes and if asked three hours later what brush strokes you made, you might not remember,” said Vandernoot. “Prior to working on a Maximus system, I had to send simulations to the render queue and wait for long periods, which would mentally take me out of a given creative train of thought.”

Vandernoot continued, “The ability to simulate fast enough to see that, ‘oh hey, tweaking this knob gives me this result,’ and the immediacy of that level of feedback is what we were able to achieve on this show. That helped us avoid the kinds of mistakes that in the past would have gobbled up valuable resources like significant processing time and man power.”

In the past, according to Vandernoot, running simulations was like flying blind. Instead of throwing the dice and running ten different simulations, rendering them to get accurate representations and wasting processor cycles on the queue in the process, with Maximus, turnaround time was much faster and delivered a much more accurate representation of the final render.

Faster Iterations, Greater Detail

Using Houdini 12 on a Maximus system allowed SPI's artists to control the voxel data and velocity fields to bake all of the relevant smoke detail into the preview simulation without the need for additional tweaking at the time of render.



A testament to this process was evident when simulating a smoke trail in a key rocket launch shot. “We had an artist who came over from our Production Services department, and hadn’t spent a lot of time working with VFX tools. He was able to dive in immediately and work on a shot where there was a 22-meter smoke plume off-gassing from a rocket that required art directed fluid simulations. We had to iterate that shot dozens of times—all of the iterations looked great, but the director had a very specific vision in mind. We never would have been able to do that volume in the time allotted without Maximus and Houdini 12,” said Vandernoot.

“The only problem with this huge boost in productivity was how quickly we were running out of disk space,” joked Vandernoot. “This workflow allowed us to iterate so quickly that we often didn’t have time to offload the simulations we weren’t going to use, since they all looked so good. We were creating many terabytes of smoke simulations daily, and could easily overwhelm the rest of the facility with the added boost of GPU optimization.”



Looking Toward the Future

SPI just started to scrape the surface of what's possible with Houdini 12 and NVIDIA Maximus on this show, and anticipates further pipeline optimizations on future productions. "We were able to realize phenomenally fast, multi-threaded, GPU optimized grid-based volume simulations in our smoke pipeline and look forward to taking advantage of other GPU accelerated tools within Houdini and our lighting package as well," said Vandernoot.

SPI is also using this same smoke pipeline for visual effects on the upcoming *Wizard of Oz* prequel, *Oz: The Great and Powerful*, and other films in production.

"One thing moving forward would be to send renders off to a queue that is GPU-enabled. It would be great to have the same sort of speed increases that we experience with simulations on our local machines on the fully baked rendering side of our workflow as well," concluded Vandernoot.

Men in Black 3 opened in theatres on May 25th and grossed over \$200 million in box office earnings in its opening weekend.

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