



**NVIDIA**®

**OpenGL ES Performance (and Quality)  
on the GoForce5500 Handheld GPU**

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# NVIDIA GoForce Handheld GPUs



Powering handheld device today and tomorrow:

Motorola  
RAZR V3X



SonyEricsson  
W900i



Motorola E1120



Motorola 770v



# NVIDIA GoForce5500 Overview



## ● World-class 3D

- HW Geometry pipeline
- 16/32bpp textures and color buffers
- Programmable pixel shading
- QCIF, QVGA, VGA, XGA screen sizes!

## ● Integrated multimedia features

- HW video decode (video textures!)
- HW video encode (videoconferencing)
- HW camera support (live camera into a texture!)
- HW audio support

# NVIDIA GeForce5500 3D



- **Geometry Pipeline**
  - HW Transforms
  - Vertex Buffer Object Support
- **High-performance Texturing**
  - 1024x1024 textures
  - Mipmapping w/ trilerp
  - Compressed textures
- **Powerful pixel shading programs**
  - Up to 5 textures (and 12 texture samples!) per pass
  - Complex shader instructions
  - Access to depth and framebuffer per pixel



# Handheld Performance Considerations

- The GPU doesn't exist in a vacuum
- Balance the three major system components:
  - CPU
  - System bus
  - GPU
- Any one of them can kill performance
- But on HW-accelerated handhelds, the GPU is the *least* likely candidate as the initial bottleneck today...

# Handheld CPUs



- Lower power than PC equivalents
- ARM9 common
  - No FPU
- ARM11 starting to appear
  - FPU is optional
- Caches are smaller

# Minimizing CPU Work



- **Know your CPU**
  - **Avoid floating point on an ARM9!**
  - **Be careful with it even on ARM11+VFP**
  - **Be cache-friendly**
- **Avoid redundant render state changes**
- **Avoid multi-pass rendering**
  - **Use multitexture and shaders to avoid it**

# Minimizing System Bus Traffic



- **Use VBOs wherever possible**
  - Mark them as `GL_STATIC_DRAW` when possible
  - Use VBOs for index buffers, too! (almost always static)
- **Avoid texture loads per frame**
  - Use render-to-texture (and shaders) for dynamic textures
- **Don't read back the framebuffer**
  - Unless you are taking screen shots...



# Maximizing GPU Performance



- **Maximize texture throughput:**
- **Use compressed textures**
  - GoForce supports DXT1/3/5 natively at full performance!
- **Use mipmapping**
  - But use trilerp only when needed
- **Use single-pass multitexture and shaders**
  - Create large “virtual textures” by composing smaller ones

# Compelling Content through Shaders



- **NVIDIA GoForce GPUs can render multiple textures in a single pass with complex effects**
- **Increased content quality with fewer passes**
  - **And less (expensive) alpha/pixel blended rendering**
- **Render to texture can be used to create complex effects without per-textel CPU work or bus transfers**
- **The following demos will show all of this and more**

# Logo / Video Demo!



# Siege Demo!





# Maximizing Performance: Development Tools

## ● NVIDIA PerfHUD ES!

- Real-time performance-tracking for handheld apps
- No source code modifications required
- Come see a live demo in the booth

## ● NVIDIA Handheld SDK

- Demos (3D, Input, Effects; Audio, Video, Camera coming)
- Extensive documentation
- Cross-platform development tools



# Maximizing Performance: Carbon-based Tools!

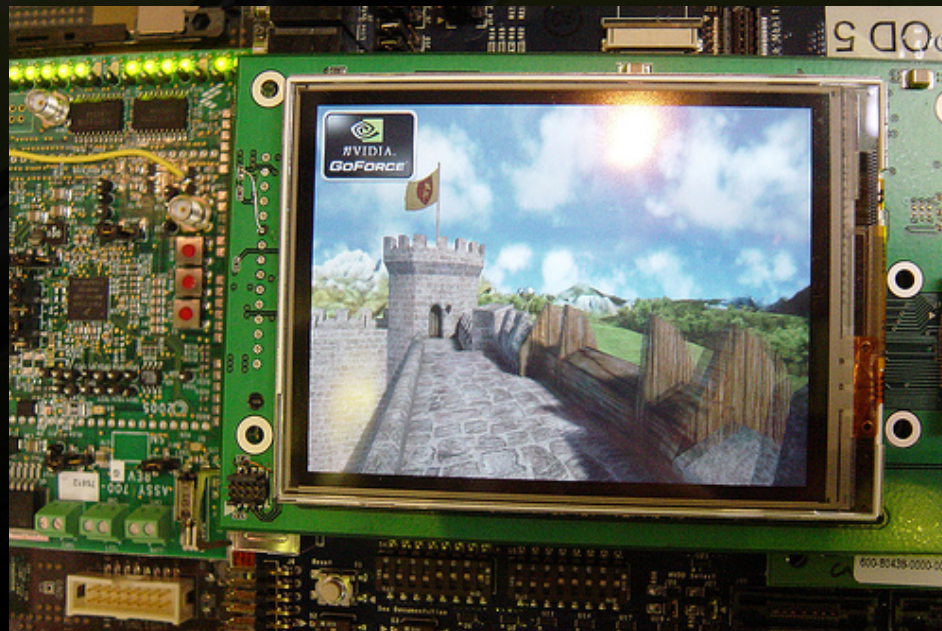
- **NVIDIA Handheld DevTech!**
- **We're here to help you make your apps look and run great on NVIDIA's GoForce GPUs with:**
  - **Devkit setup support**
  - **SDK support and updates**
  - **Performance tuning assistance**
  - **Visual effects and integration ideas/assistance**

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# Questions??



Come see a live demo of the GoForce5500 in the booth



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