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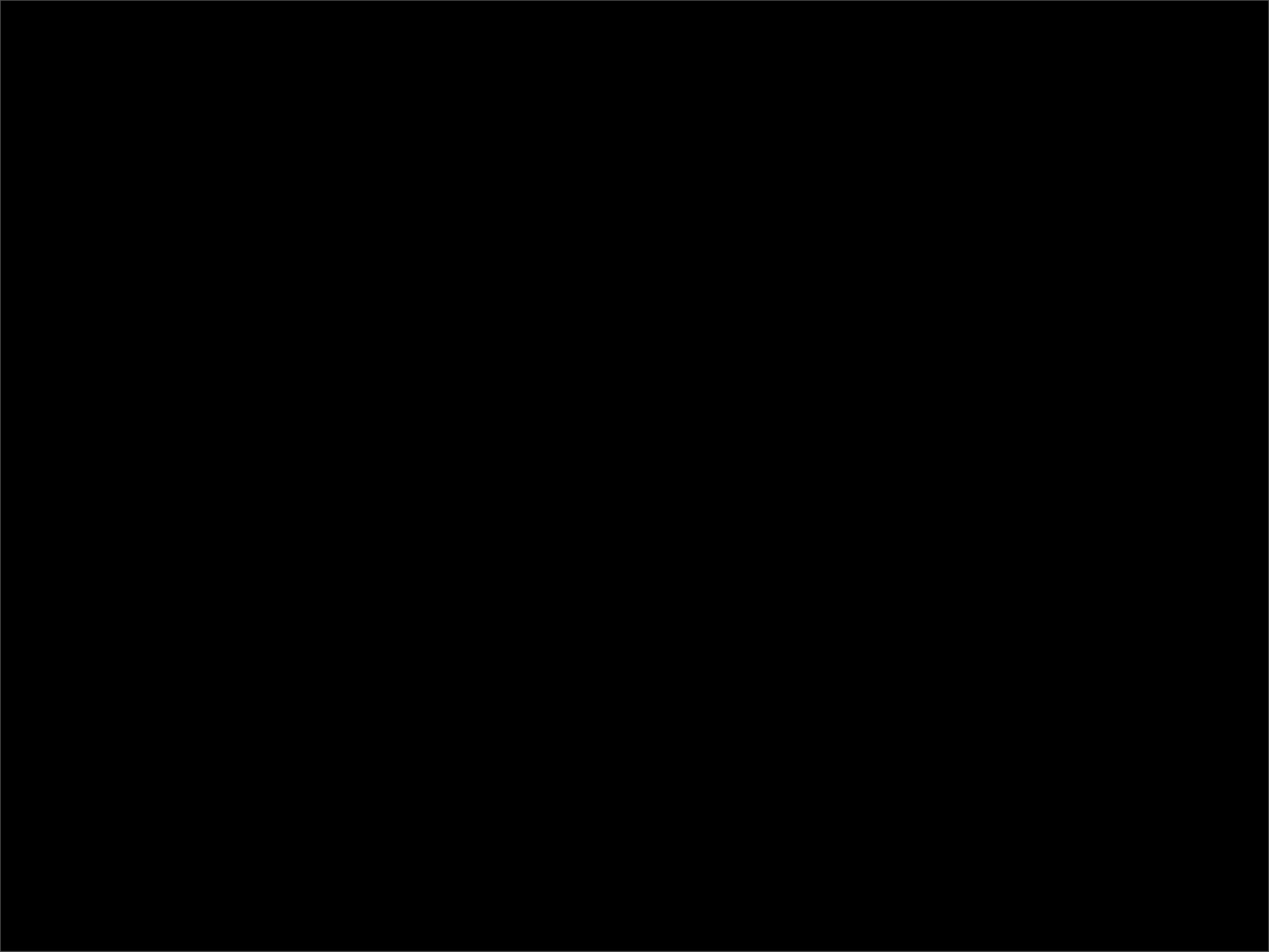
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Jan-Bart van Beek

Art Director - Guerrilla Games

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SONY

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Killzone 2

- Announced E3 2005

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- Concept started late 2005

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- 18 months Full Production

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- 140 Guerrilla Games Staff

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Killzone 2

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- Preproduction till end 2006
- Production till end 2008
- 18 months Full Production
- 140 Guerrilla Games Staff
- 50 Sony Staff

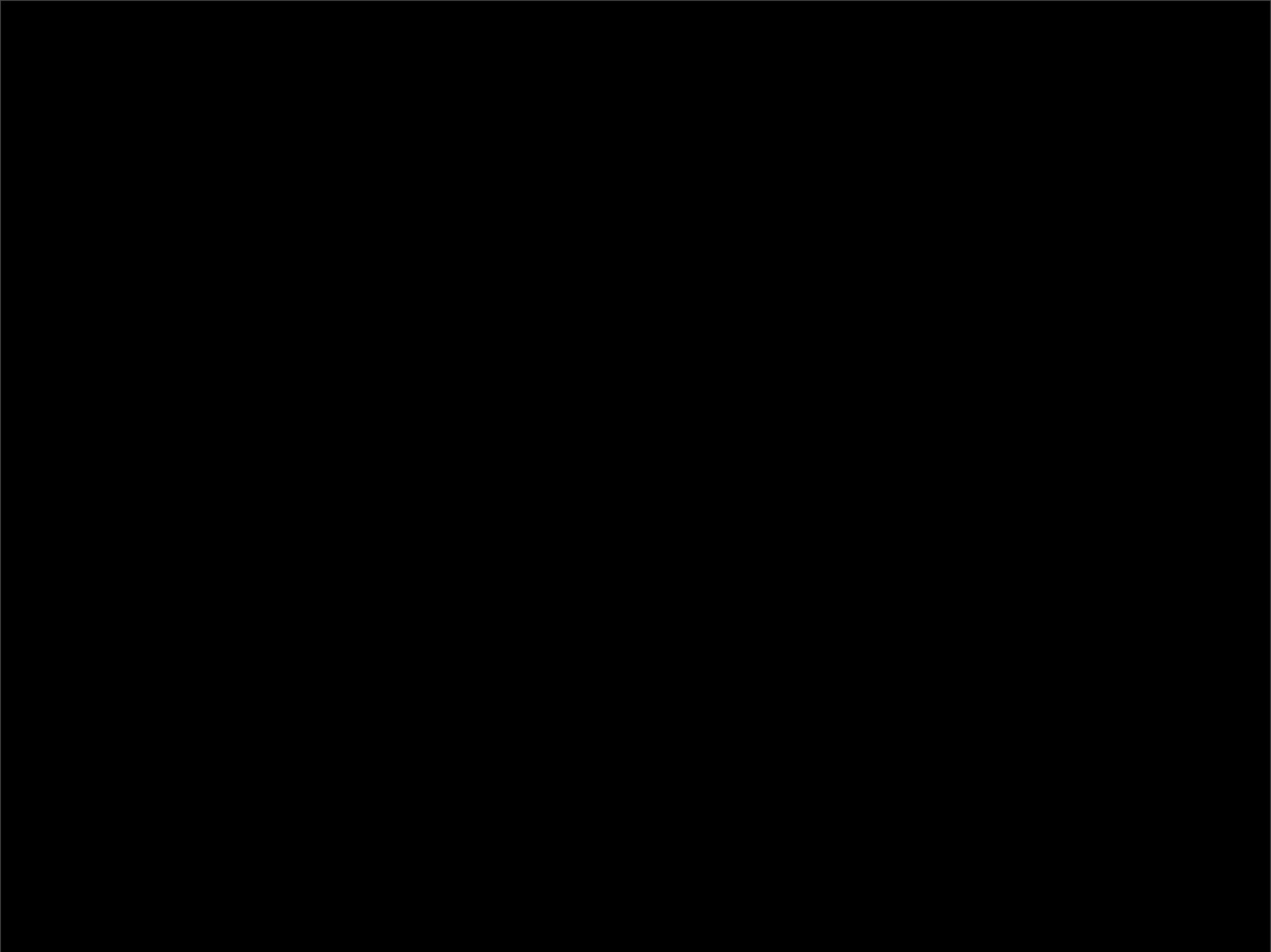
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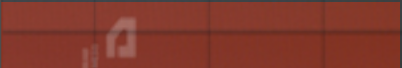
Killzone 2

- Announced E3 2005
- Concept started late 2005
- Preproduction till end 2006
- Production till end 2008
- 18 months Full Production
- 140 Guerrilla Games Staff
- 50 Sony Staff
- 4 Outsourcing Partners

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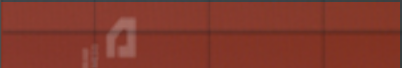
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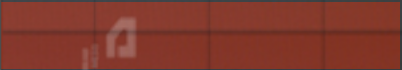
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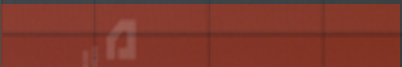
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producers

Audio

QA

Designers

Tech

Art

IT

HR

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Deferred Rendering

- The Quick Explanation
 - Engine does not render directly to screen
 - First fills off-screen buffers with material data
 - Then renders all lighting as a screen effect



Show Movie of Deferred Rendering

Guerrilla - November 2008

Deferred Rendering

- Pro and Cons
 - The Pros
 - No lighting Calculations in the Shaders
 - No light limit per object
 - 'Infinite' amount of dynamic lights
 - About 350 in heaviest levels
 - 'Infinite' amount of shadow-casting lights
 - About 8 active usually
 - Dynamic Shadows fade out over distance

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Deferred Rendering

- Pro and Cons
 - The 'Mythical Cons'
 - No Anti-Aliasing
 - No Shader Flexibility
 - No Transparencies



Tim Sweeney
CTO, Epic Games





Deferred Rendering

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Deferred Rendering

- Pro and Cons
 - The Cons

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Deferred Rendering

- Pro and Cons
 - The Cons
 - Costs about 22Mb of VRAM extra

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Deferred Rendering

- Pro and Cons
 - The Cons
 - Costs about 22Mb of VRAM extra
 - No Mixing of Alternative Lighting Models

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Deferred Rendering

- Pro and Cons
 - The Cons
 - Costs about 22Mb of VRAM extra
 - No Mixing of Alternative Lighting Models
 - No lighting-dependent Shader Variable

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Deferred Rendering

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 - » shaders that change look based on lighting

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 - » shaders that change look based on lighting
 - No Cartoon rendering
 - No Sub-Surface Scattering - Skin



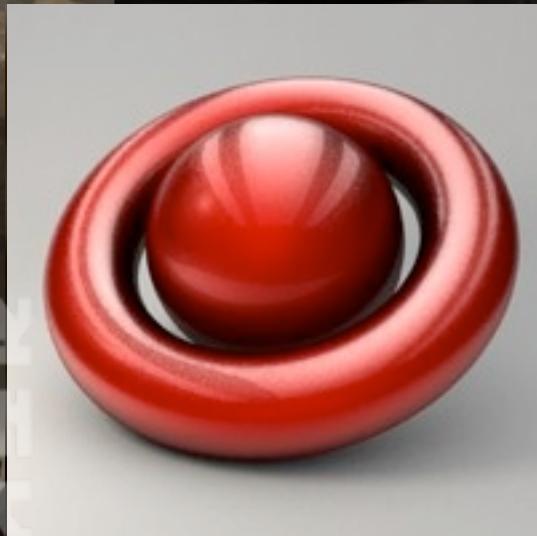
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 - No Anisotropic Speculars - Hair



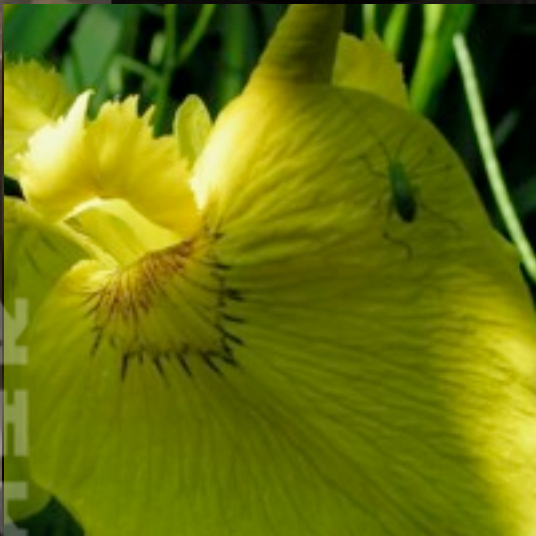
Deferred Rendering

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 - No Anisotropic Speculars - Hair
 - No Custom fall-offs for Diffuse or Speculars - Car Metals



Deferred Rendering

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 - No Cartoon rendering
 - No Sub-Surface Scattering - Skin
 - No Anisotropic Speculars - Hair
 - No Custom fall-offs for Diffuse or Speculars - Car Metals
 - No Translucent Materials - Leaves



Deferred Rendering

- What about the 'Mythical Cons' ?
 - Anti-Aliasing ?
 - Simply solved - 2xMSAA Quincunx
 - Transparencies ?
 - Done by Secondary and Tertiary Renders
 - Second is Full-Res AA - Geometry
 - Third is Half/Quarter Res - Particles
 - Shader Flexibility ?
 - Very Flexible & Intuitive Shader Creation Tools
 - Loads of clever tricks to get same look

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Shader Creation

- Development History
 - First Shader Creation System based on Maya's Layered texture Node
 - Realised Next-Gen Art was all about Quality of Shaders
 - Decided to fully adopt Maya's Hypershader Workflow
 - Logical and Well-developed Workflow
 - Wanted our Tools to stay in-Maya
 - CG Artists already accustomed to Workflow and Tools
 - Same Workflow as Shader Development for Software Renderers
 - Maintained compatibility with Mental Ray for a long time
 - Helped initial development to match look
 - Became redundant once system was completed

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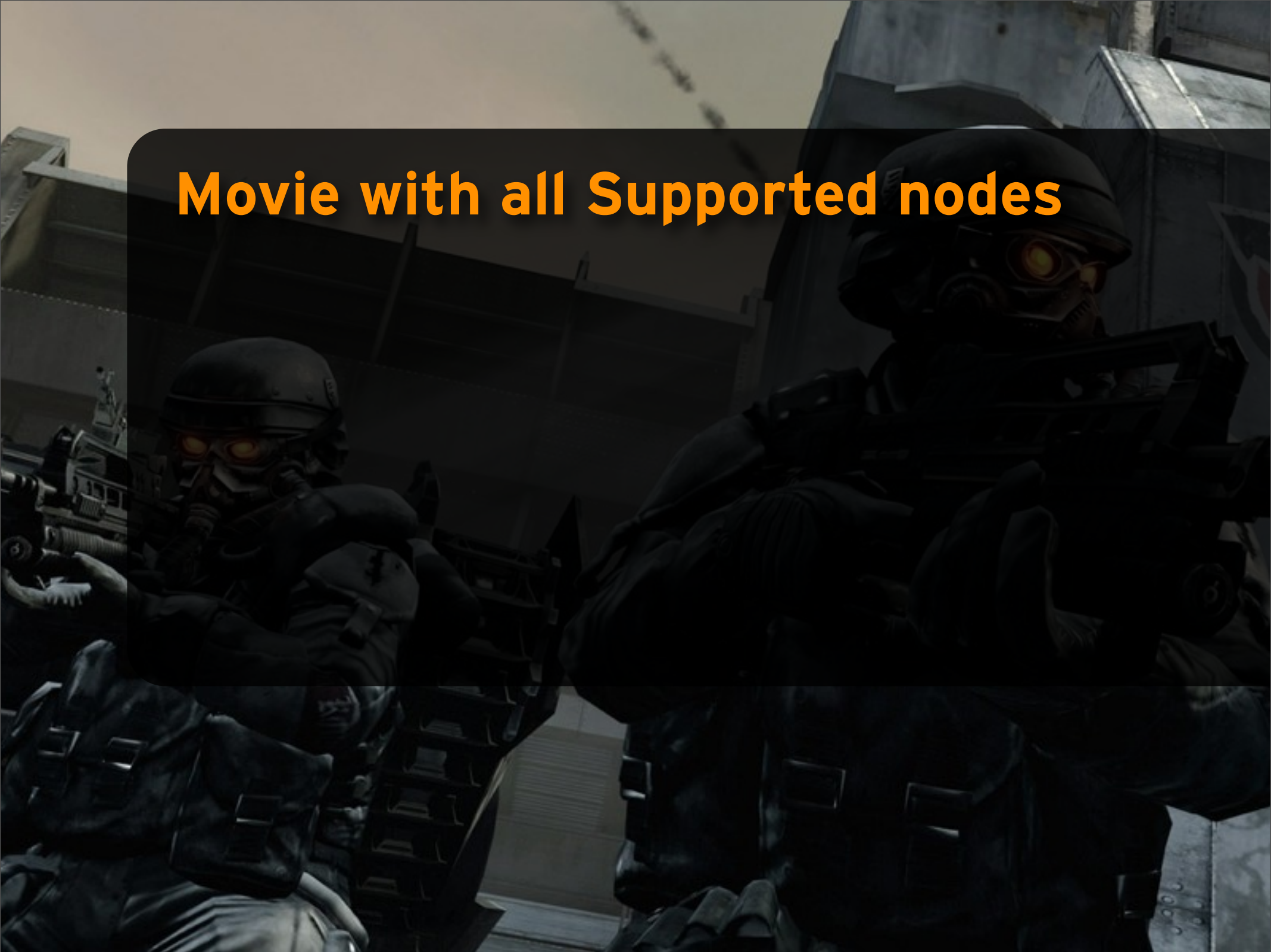


Shader Creation

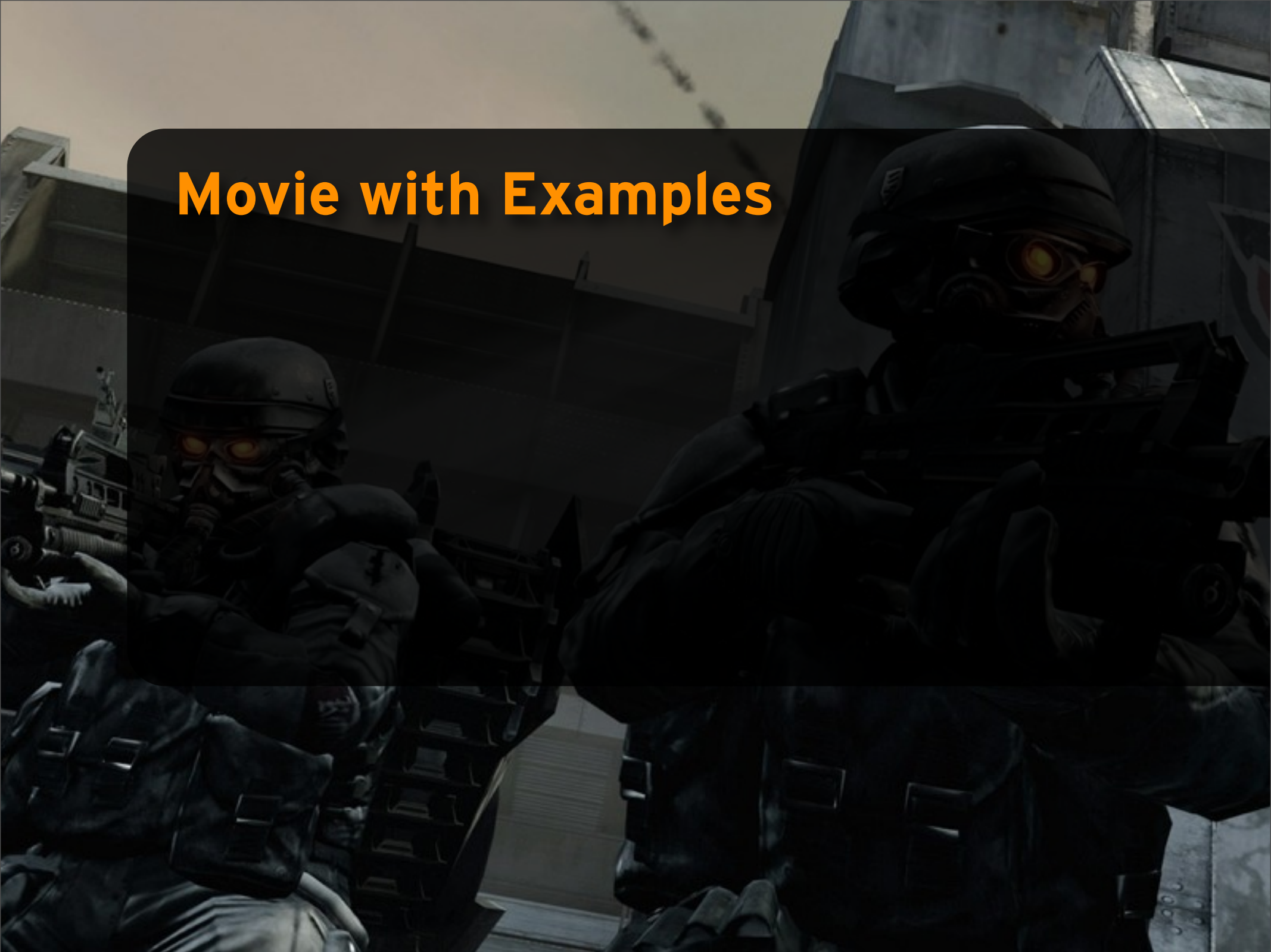
- Current State
 - All required Maya Shading Nodes supported
 - Game Engine runs in Maya Viewport - WYSIWYG
 - Single Tool for all Content Creation Tasks
 - No need to export to different tools to create shaders
 - Minimal Support needed from GFX Coders
 - only for creating support for new nodes

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Movie with all Supported nodes



Movie with Examples





Level Building Blocks

- Development History
 - Late 2006 - Made the first Proof of Concept Level



Level Building Blocks

- Development History
 - Problems
 - Enormous Amount of Effort
 - Over 30 man-months for a multi-player level
 - Difficult to Art Direct
 - Level Quality not visible till 80% into production
 - Very Laborious to Edit
 - No Instanced Content from a Repository
 - Much Time spend on Technicalities
 - Hand-built LOD's and Physics Meshes
 - Redesign Methodology to Resolve all these Problems

Level Building Blocks

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Level Building Blocks

- Current State
 - Based on Unreal Ed's Static Meshes
 - Building Blocks are Modelled, Shaded, LOD'ed in Maya
 - Most of these are Outsourced
 - Exported into a Repository for use by Level Artists
 - Level Artists place, scale and rotate BB's in Maya
- 90% of Level Geometry is Instanced from Repository
- Killzone 2 was build with 1500 BB's

Level Building Blocks

- Asset Management
 - Tech Art Team created the assetDB
 - Stand-Alone Tool that Communicates with Maya
 - Allows Artists to do thing like:
 - Add BB's to a Level
 - See which BB's are in a level
 - Swap BB's for other BB's
 - Open a BB in Maya for Editing

Level Building Blocks

- Asset Management
 - assetDB doubles as an Optimization Tool
 - Creates Reports on statistics like :
 - Number and Type of BB's used
 - Memory Footprint
 - Polygon count for Level Geometry and Physics Hull
 - Polygon Ratio between High and Low LOD of BB
 - Shader Complexity
 - Reports showed best candidates for optimizing

Movie of assetDB is use

Level Building Blocks

- Asset Management
 - assetDB became the primary tool for level art and design
 - Ironical as it was initially intended for programmers
 - It was further expanded to include content like :
 - Level Design Markers
 - Special Effects
 - Environment Shaders
 - Props
 - Lights

Level Building Blocks

- Level Creation
 - Levels are build up from BB's
 - Always some hand-modelled geometry as well (BSP)
 - BB's are grouped in lightmap groups of about 1000
 - Used by the automated lightmap UV generation
 - Process is called **UV-shifting**
 - Every BB's gets a set of Offsets and Scalings to define where it resides in the Level Lightmap
 - Shader of BB's uses the coordinates to display the correct part of the lightmap

Movie of UV-Shifting

Level Building Blocks

- Level Creation - Export Process
 - Various Automated Processes run at Export
 - Auto-Generation of LOD geometry
 - Auto-Generation of Physics Hull geometry
 - Auto-Optimising of Shaders on LOD's
- Problems
 - Tweaking BB geometry or shaders requires re-exports of levels
 - Future plans - Run Processes at Content Conversion Time

Shader Repository

- Similar philosophy as Building Blocks
 - Instanced Content from a Repository
 - Easy to make Global Changes to the Game
- Shader is created in Maya and exported to assetDB
- assetDB is used to assign shader to Level Geometry
- On Export Shader is exported as a Link to Repository

The background of the slide is a blurred image of soldiers in a game environment. One soldier in the foreground is wearing a helmet with a night vision or thermal imaging device and is holding a rifle. Another soldier is visible in the background, also in similar gear. The scene is dimly lit, suggesting an indoor or nighttime setting.

Shader Repository

- PolkaDot Shading - Non-Linear Texture Blending
 - Instanced Content from a Repository
 - Easy to make Global Changes to the Game
- Shader is created in Maya and exported to assetDB
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Impact on Workflow

- Problems
 - Enormous Amount of Effort
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 - Very Laborious to Edit
 - No Instanced Content from a Repository
 - Much Time spend on Technicalities
 - Hand-built LOD's and Physics Meshes

Impact on Workflow

- Effect of new Workflow
 - Reduction on Cost
 - 12 man-months for a Single Player Level
 - 9 man-months for a Multi player Level - 3x Faster !
 - Easier Art Directional Process
 - Separated Development Track
 - One focussed on BB's and Shader creation
 - One focussed on Level Creation
 - Focussed Artists Efforts and Reviews
 - Reduced Discussion
 - Attention-to-Detail vs The-Big-Picture
 - Higher Quality Art

Impact on Workflow

- Effect of new Workflow
 - Easy Global Editing of Content
 - Also introduced risk of creating Global Bugs
 - Rarely manifested during Production
 - Automatic Content Generation Rocks !
 - No more Hand-Modeling of Level Geometry LOD's
 - No more Hand-Modeling of Level Physics Hulls
 - Very easy way to Optimize
 - More Time for Artists to focus on Artistic Qualities

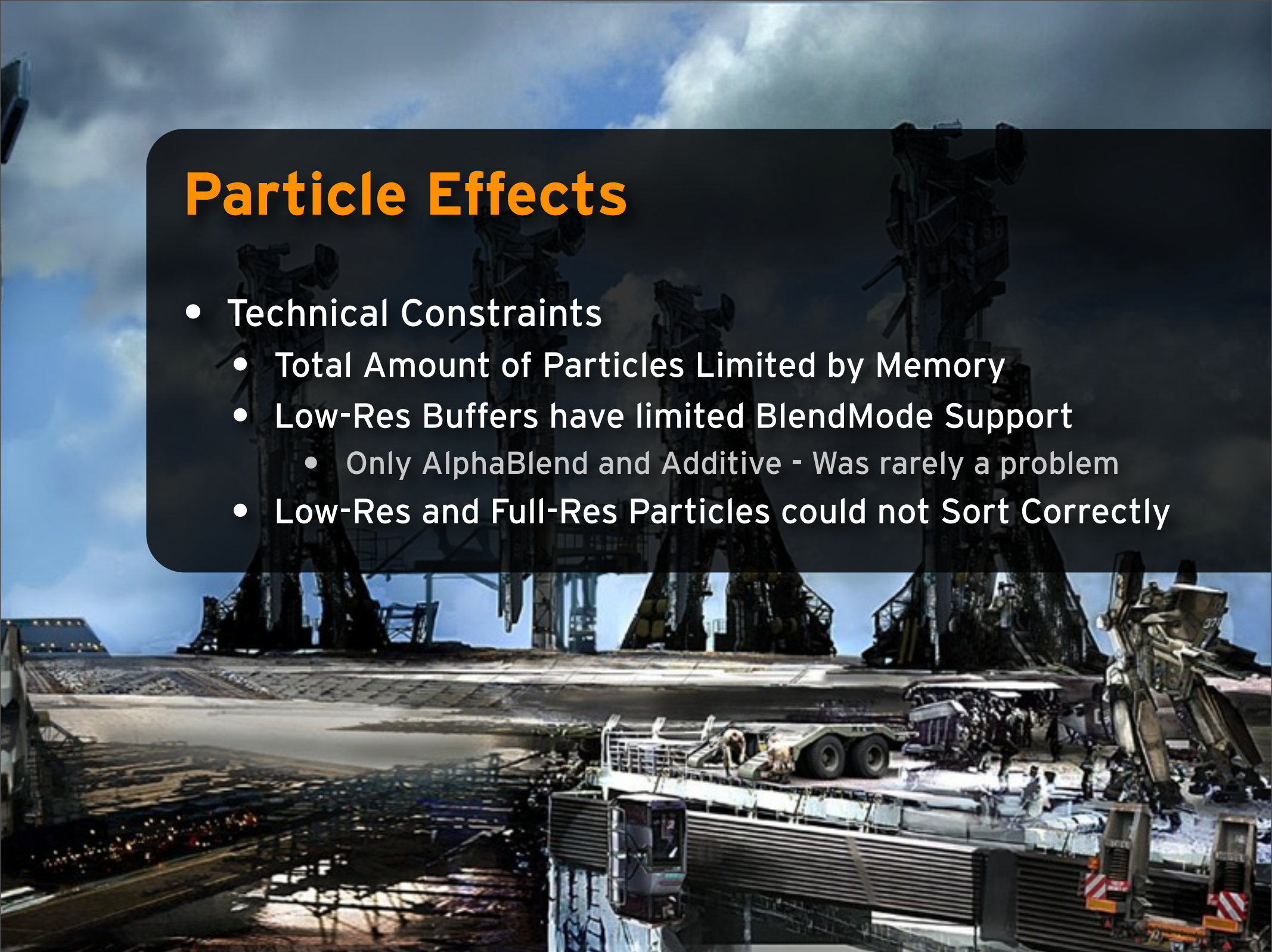
Particle Effects

- Technical Niceties
 - All Particle System set-up is run on SPU's
 - Handles about 300 Systems and 5000 Particles per Frame
 - Handles about 200 Particle Collisions per Frame
 - Support for Recursive System
 - Particle Effect Collision spawning New Particle Effects
 - Particle Driven Shader Variables
 - Low-Res and Full-Res Buffers to optimize Performance



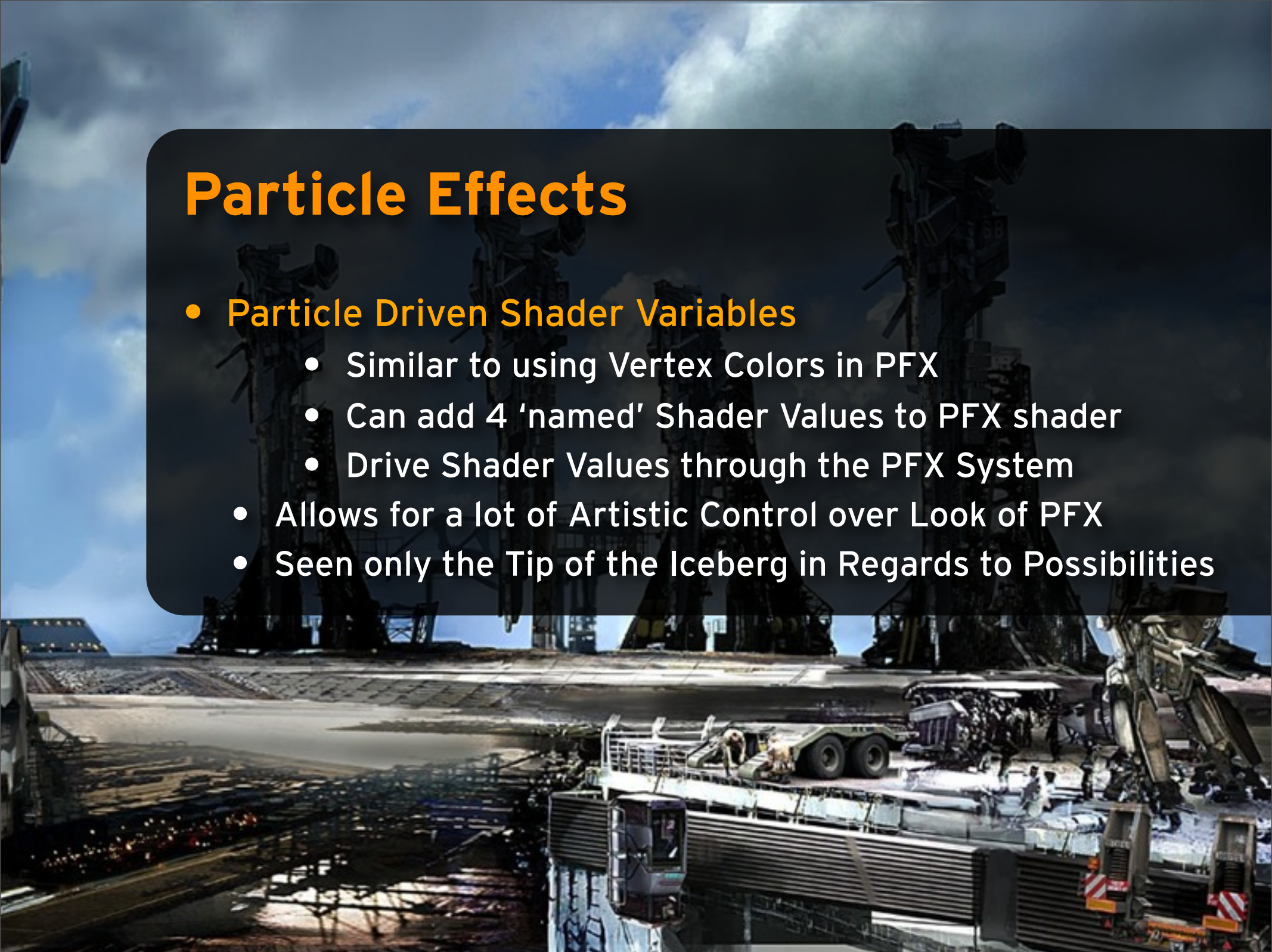
Particle Effects

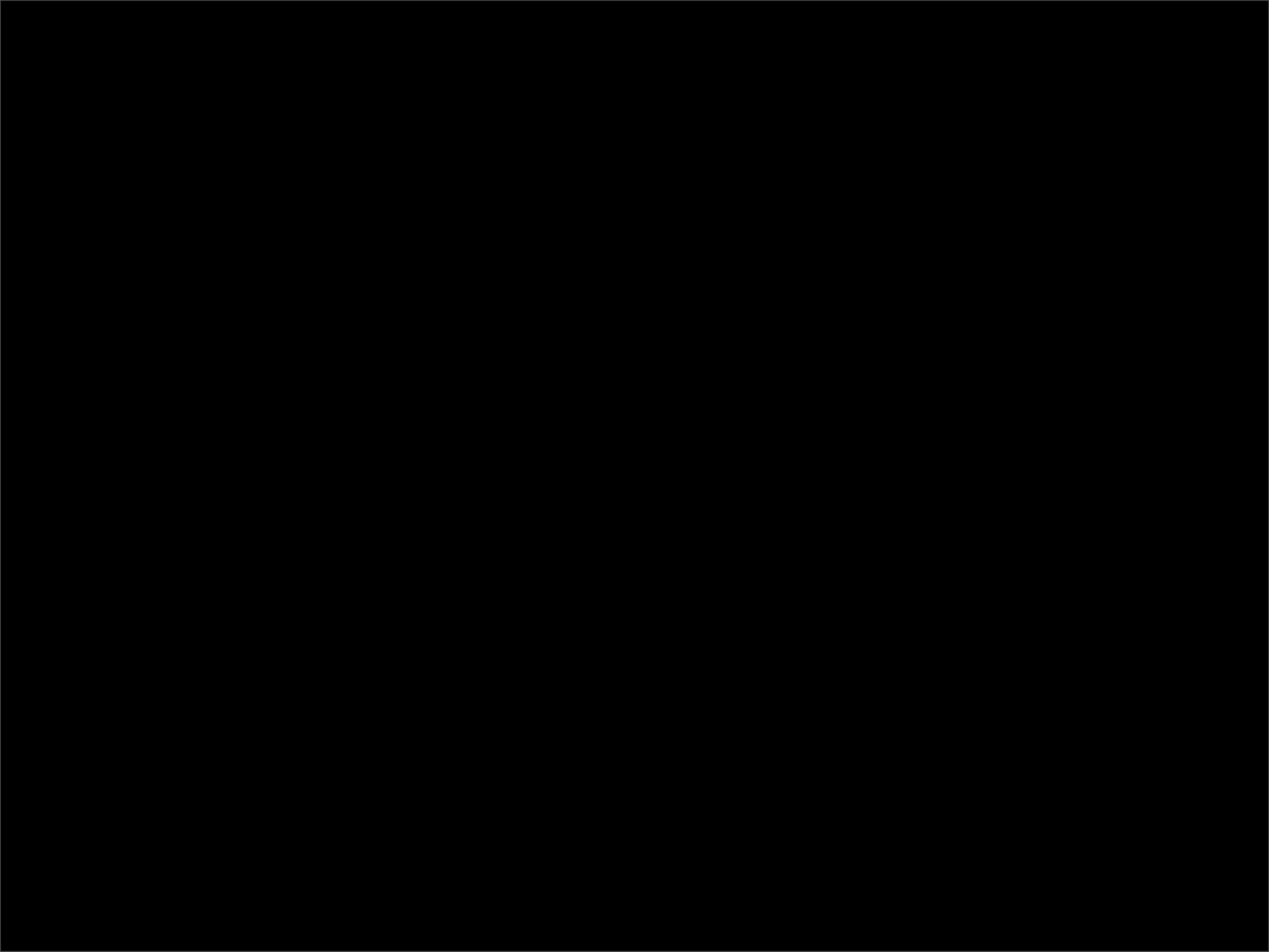
- Technical Constraints
 - Total Amount of Particles Limited by Memory
 - Low-Res Buffers have limited BlendMode Support
 - Only AlphaBlend and Additive - Was rarely a problem
 - Low-Res and Full-Res Particles could not Sort Correctly



Particle Effects

- **Particle Driven Shader Variables**
 - Similar to using Vertex Colors in PFX
 - Can add 4 'named' Shader Values to PFX shader
 - Drive Shader Values through the PFX System
- Allows for a lot of Artistic Control over Look of PFX
- Seen only the Tip of the Iceberg in Regards to Possibilities





Future Plans

- 'Dirtmap' Driven Shader Variables on BB's
 - Allow for easy 're-skinning' - Ice, Rust, Soot, Moss, etc
- Automated LightMapping at Rendering Time
 - Less Human Error, less Time Wasted
- Expand Shader Creation Workflow to support Vertex Shaders
 - Add Simple Motion to World - Water, Hair, Cloth, Grass, etc
- Merge Several Stand-Alone Custom Tools
 - Less Maintenance, Less Clutter, Single Interface
- Rework Tools to create Turn-Key Software Package
 - Easier Outsourcing

A background image showing two soldiers in full tactical gear, including helmets with night vision and goggles, running through a doorway. The soldier in the foreground is holding a rifle and has a small screen on his leg. The scene is dimly lit, with light coming from the doorway.

**Thank you for Listening.
Any Questions ?**