Presenter Rendering with Navisworks

When rendering with Navisworks, especially when rendering movies/animations, it's important to understand the implications of various settings on rendering times and the impact on RAM. This document is intended to provide an understanding of some of the rendering considerations, and where possibly to provide tips and tricks to achieve the output you require in an acceptable time.

All Navisworks Users

Multi-Core Machines

Autodesk Navisworks software is single-threaded and runs on a single processor. When rendering from Navisworks you will therefore *not* achieve any *direct* benefit from using a machine with multiple cores/processors. Indirect benefits may be achieved by allowing other applications (or additional Navisworks sessions) to run on any additional cores/processors. However, be mindful of memory usage/requirements. See below.

Memory Usage

If working on a 32-bit machine, even with the 3GB switch enabled, any process is limited to 3GB RAM. Therefore, if you are loading a large dataset which approaches this memory limit when loaded, then there will be little to no memory overhead to perform complex Presenter renders. [I'll come back to what I mean by a 'complex' Presenter render later in this doc]. When working with large datasets here are a few tips/options available to you:

- Ensure your complete model is saved into the NWD format – this is the most optimized format for Navisworks, enabling the application to utilize its own memory management functionality.
- Limit the complexity of Presenter effects – I'll discuss this in more detail later in this doc, but essentially use simple materials and lighting.
- Export animations as still images – rather than exporting an AVI, which needs to be stored in memory in its entirety, exporting to sequential still images creates the animation one frame at a time, lowering the requirement on memory. This method does however require the use of a third party application (e.g. Photoshop) to 'stitch' the frames together to create your movie file.
- 64-bit operating systems – moving to a 64-bit operating system can enable you to significantly increase the amount of RAM on your machine. However, be aware that your motherboard will usually limit you (to say, 8GB or 16GB) if you're simply upgrading RAM.

Minimum vs Recommended Specification

Presenter rendering is a processor intensive operation, so if you intend to render animations of large datasets with complex lighting (discussed later in this doc) on a regular basis, then you may wish to consider investing in a machine that can be dedicated to this operation.

Although the minimum requirements to run Navisworks software are quite low, a minimum spec machine will struggle to load large datasets (due to memory limitations) and if loaded, will struggle to perform operations such as rendering and even navigating. If you are considering investing in a machine for Navisworks, the following specifications should be considered:

- Intel© Pentium© IV (or equivalent), 3.0 GHz or faster
- 4GB RAM or greater for rendering (will require 64-bit Operating System for more than 4GB)
- OpenGL graphics card (essential for real-time navigation of large models)

Materials

Applying any Presenter materials will have some impact on the time it takes to render the scene. It's therefore advised to use material assignment with due consideration. It's recommend to only use materials where necessary. For example, if you require reflections in windows, then applying a glass material will be necessary, however if the reflection is not essential, then do not apply a material, simply change the colour of the glass object(s) to say, light blue, and override the transparency until you can see through the glass. This is also true of shiny materials such as polished aluminium/chrome. Although making all of your MEP services shiny may look good, they will reflect all of their surroundings which increase the calculations required and therefore the render time. An alternative may be to make the majority of the MEP objects a pale grey colour, and apply a shiny material to select pieces of equipment to 'dress' the scene. Think "less is more".

Simple Lighting

Lighting and the shadows they cast create the biggest impact on rendering times. In order to keep rendering times down you should try to keep lighting simple. If you have a complex model, then simple lighting may also be preferred as the attention is more focused on the model, rather than being distracted by shadows and effects. Simple lighting is generally more desirable for animations where the output is likely to be recreated on a regular basis as the project progresses.

A good starting point for simple lighting is to use the *Standard Light Studio* (found under the recommended light archive). This provides you with three light sources, which you can tweak to suit your scene.

Double click on each light to open the Light Editor. From here you can adjust the Intensity value, which will make that particular light source brighter/dimmer. For the Standard Light Studio, try setting the Ambient light intensity to 0.4, the Eye light intensity to 0.3, and the Distant light intensity to 1. Also for the Distant light try enabling Shadows. To change the position of the Distant light (to change the shadows being cast), I recommend setting the focus to the center of the image you're creating, and then Orbiting around this (and zoom out as necessary), so

that the camera is positioned where you want the 'sun' to be, looking in the direction you wish to cast shadows. Right click on the Distant light and select Position As Camera.

This provides a good simple base for your lighting – this as is may be adequate, but you may also wish to add a Point light, for example to an area of the scene that is too dark; or a Spot light to highlight, or draw attention to a specific area of the scene.

You may also wish to consider changing the colour of any of your lights to create a different effect. Once you have your base lighting, you will generally need to experiment with any additional lighting to create the effect you require. As with materials, remember that *less is more* when it comes to simple lighting (and quicker rendering times).

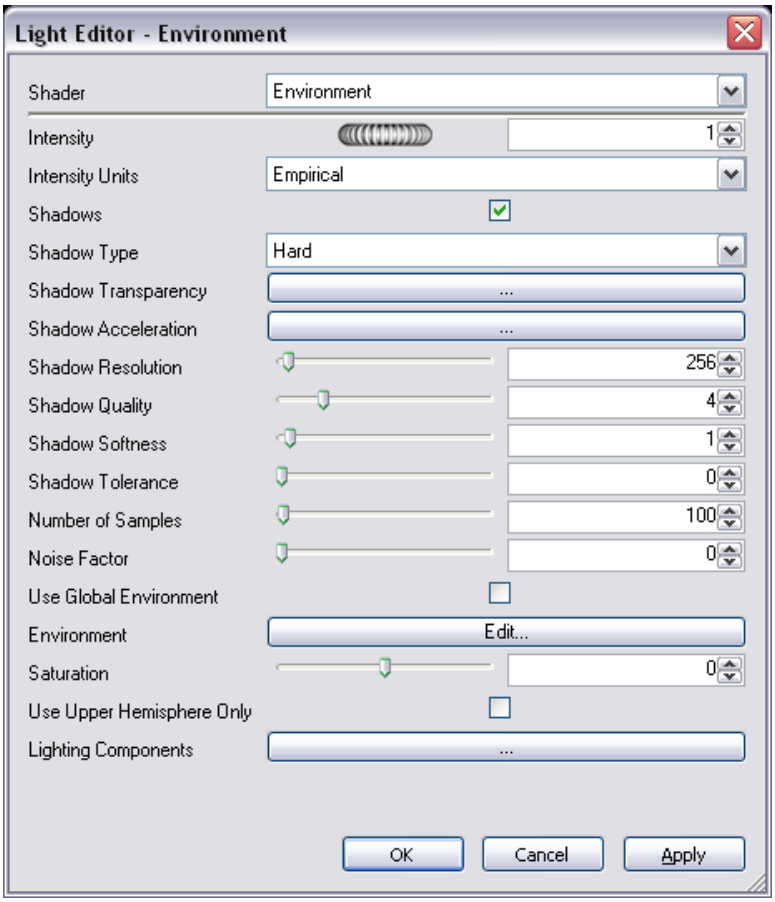
Complex Lighting

More complex lighting can be used for renderings that are required for presentation/marketing purposes, where the output is likely to be more of a one-off. This is due to the additional time it will take to render the output, which you would generally not be able to achieve on a regular basis.

Navisworks supports the use of High Dynamic Range Images (HDRI) for background effects (where the background 'moves' as you navigate around the model) and lighting (for real-world lighting and shadow casting). There are a couple of HDRI options provided with Navisworks, though more can be found on the web (e.g. http://www.doschdesign.com/products/hdri/). This is also referred to as Environment lighting (and backgrounds).

A good starting point for complex lighting is to use the *Environment Light Studio* (found under the recommended light archive). This provides you with a general Ambient light and the default Environment light (which uses a default city HDR image).

Double click on the Environment light to open the Light Editor. From here you can adjust various options to tweak the lighting.



Click on the Environment *Edit…* button if you wish to use a different HDR image (simply browse to the File Name of your choice).

Number of Samples is a key option for determining the render time and also the quality of the effect you'll create with environment lighting. Increasing the sample rate to say, 800 will create a very good output with very detailed reflections and subtle shadows, however it will take a *long* time to render a single frame, which needs to be born in mind when rendering an animation of hundreds/thousands of frames. You may be able to reduce the sample rate to say, 50 to provide adequate results whilst achieving a more acceptable rendering time. The distance of the camera from the model will play a role in this. If you are close to the model, then it's likely you'll need a higher number of samples as you'll be able to see the detail much more clearly. If further away from the model, the detail is less clear, enabling you to use a lower sample number.

Intensity is another option you may need to adjust slightly. Try rendering the scene having set the other options and adjust the Intensity as necessary (increasing to say, 2 to make the scene brighter, for example).

Another tip for most AEC models is to enable the *Use Upper Hemisphere Only* option - if you have a ground plane, there is obviously no need to be rendering any lighting below ground.

Other Considerations

- If you are unable to export an AVI due to running out of memory, then as mentioned earlier in this doc, it you may choose to export the animation as sequential still. A further option available to you is to split your animation into sections, and render each section on separate machines. This isn't a particularly elegant solution, rather a workaround to create a manual 'render farm'. Take a 2-year TimeLiner simulation for example. You could create four NWD files, each one limited to six months of the simulation. These could then each be rendered on separate machines and stitched back together (using third party editing software).

- For longer animations, you may also wish to consider OpenGL rendered output as this is much quicker to render. You will not see shadows and reflections with this method; however you can see basic materials. Try increasing the Anti-Aliasing level for improved quality.

- Note that when rendering a TimeLiner simulation, it's not possible to include the date/time overlay in the output. This can only be included when rendering using the OpenGL output.

- When rendering parts of an animation on separate machines, ensure that the required viewpoint is saved in the file so that they all stitch back together correctly. This can be achieved by setting the window size (the main view within Navisworks, not the application window) to be the same aspect ratio as the final output. This option is found under View > Window Size. Using this option makes the view as big as possible (taking toolbars etc into account), whilst maintaining the same aspect ratio as the desired output. Once the window size is set, then click on your saved viewpoint – what you see, should be exactly what you get in the output.

  This is also a useful technique when composing your viewpoint in the first place, as again you see exactly what you're going to get in your output.

- Before exporting any animation, it's a good idea to try exporting a still image of the scene at the desired resolution. This serves two purposes, firstly to check that the options you've selected are satisfactory, and secondly as a still image is effectively a single frame of your animation, you can see how long the still takes to render, and then multiply this by the frames per second (FPS) and the duration of the animation (in seconds), to get an idea of how long the complete animation may take.