## Part 1: Render Preparation

*Before you go about submitting your project to Flow Render, please run through this checklist!*

- **Filenames & Folders**
    - Remove spaces and special characters ( `<>:"/\|?*` ) from file and folder names. For example, change
        - from `"My project"` to `"Myproject"` OR `"My_project"`
        - from`"my file.ma"` to `"myfile.ma"` OR `"my_file.ma"`
    - Keep filenames under 256 characters.
- **Backup Current Work**
    - Save a "**render**" version (cached, references imported, optimized). Keep the render version separate from your "**live**" version that you'll continue editing.
- **Scene Cleanup & Optimizatiom**
    - Remove any extra geometry, objects and/ or models. Only keep objects you actually want to render. (Don't just hide objects/ models.) *Back up your original scene first*, then delete extra elements in the working copy.
        - Avoid unnecessarily high-poly models;
        - Use only as many lights as necessary.
        - In Maya: **File > Optimize Scene Size** with "remove duplicate shading networks" and "remove unknown nodes" checked.
        - In Hypershade: **Edit → Delete Duplicate Shading Networks** and **Edit → Delete Unused Nodes** to reduce clutter
        - **BAKE** your Textures
        - **Delete construction history** on all your meshes - especially if there's remesh history - and Freeze Transformations
        - Consider breaking your scene up into render layers, isolating moving and non-moving elements.
        - **Cache simulations.** If you have simulations (fluid, cloth, hair), you **need** to bake any simulation to a cache file. This will solve jittery hair and cloth. Go here for help on how to create an ncache: | Create a new ncache. Note that if you make a change to animation that the simulation relies on, the cache will have to be recalculated. In the cache settings: use mcx and 1 file per frame.
        - Use large 4k textures only when necessary, otherwise stick with smaller 2k, 1k, or 512x512 textures
- **Linking Project Assets**
    - Ensure **all** project media, references, textures, caches, and other dependencies are inside your project folder and linked properly. Rerun the **File > Optimize Scene Size** if you've made changes.

- Use **Windows > General Editors > File Path Editor** to confirm textures/references point to **relative** paths within your project (not absolute), and that all referenced files (such as texture images) exist in the proper project sub-folder.

- *Missing textures are the most common cause of render errors!* — it pays to be obsessive about this.

- **Timing & Testing**

  - **Use batch render to test render times.** Note that initiating a Maya viewport render will not always accurately gauge your render times, especially if you have render layers / Render Passes active. The Maya viewport render only renders one layer at a time and one AOV at a time. If you really want to see how long a frame is going to take you have to try a batch render of a few frames.

---

## Render Settings (Details)

### Part 2: Common Tab

Your rendered images will be saved into the images folder in your project - or to a Flow images folder that is created by the Flow sub-app when you download them.

- [ ] **Naming:** Use the Name Tokens to add a File Name Prefix - for example, the scene name plus a time (Scene_Time_) - in the naming field so that you don't accidentally save over previous renders (because they have the same name and are saving in the same folder)

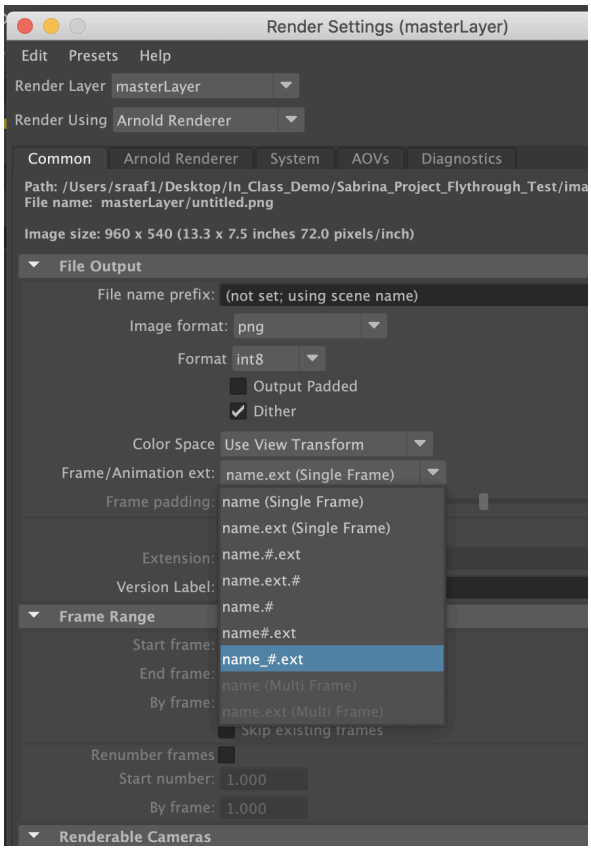
- [ ] Select **Single Frame (**`name.ext` or **Image Sequence** (`name_#.ext`) output.

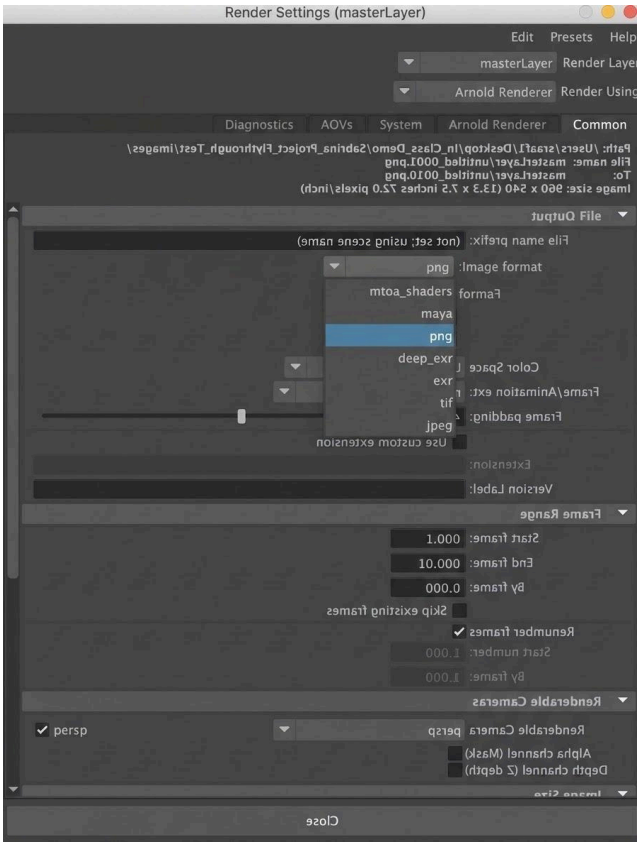
- [ ] Set your frame range. example, *start frame: 200 end frame:600*

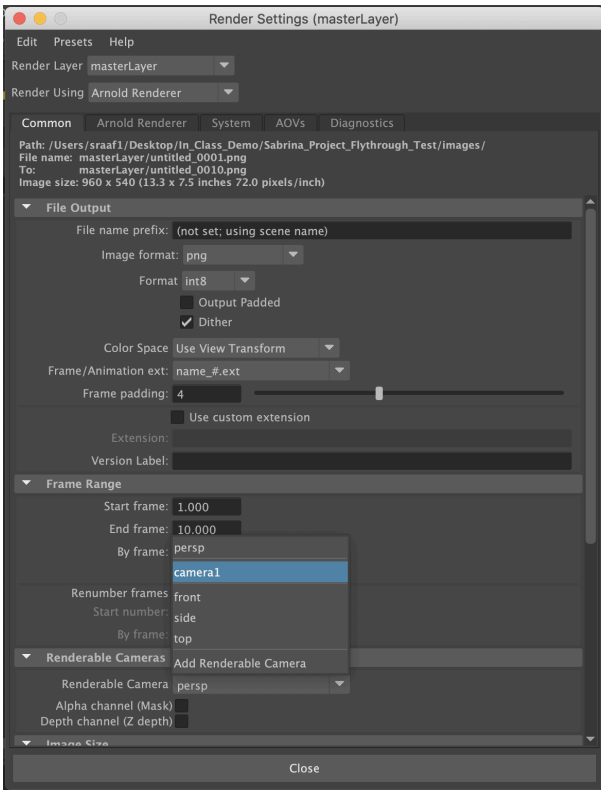
- [ ] Choose file type (**png**, **tif**, **tga,** or **exr**);
  Don't render in JPEGs (lossy). Use TGA (best) or PNG, TIFF, or EXR (lossless).

- [ ] Check **file padding** (e.g., `name_0001.png`) if you are outputting a sequence of frames (not just a single frame). **File padding** (file padding refers to the amount of zeros you put on the frame number) & extension order is appropriate: do not put the frame numbering at the end of the filename. This will break the file since it will try and read the numbers as the file extension. For Redshift users, although you cannot change the order, the default it gives you is functional.

- [ ] **Do not** save images with frame numbers at the end of their filename (e.g., `name_png.0001`). Other apps read the letters (or numbers) after the period as the file type. Adobe Premiere will not recognize 0001 as a filetype.


Render Settings (masterLayer)
Edit Presets Help
Render Layer masterLayer
Render Using Arnold Renderer
Common Arnold Renderer System AOVs Diagnostics
Path: /Users/sraaf1/Desktop/In_Class_Demo/Sabrina_Project_Flythrough_Test/ima
File name: masterLayer/untitled.png
Image size: 960 x 540 (13.3 x 7.5 inches 72.0 pixels/inch)
File Output
File name prefix: (not set; using scene name)
Image format: png
Format int8
Output Padded
Dither
Color Space Use View Transform
Frame/Animation ext: name.ext (Single Frame)
Frame padding:
name (Single Frame)
name.ext (Single Frame)
name.#.ext
name.ext.#
name.#
name#.ext
name_#.ext
name (Multi Frame)
name.ext (Multi Frame)
Extension:
Version Label:
Frame Range
Start frame:
End frame:
By frame:
Skip existing frames
Renumber frames
Start number: 1.000
By frame: 1.000
Renderable Cameras


Render Settings (masterLayer)
Edit Presets Help
masterLayer
Arnold Renderer
Diagnostics AOVs System Arnold Renderer Common
File Output
Image format
png
mtoa_shaders
maya
png
deep_exr
exr
tif
jpeg
Frame Range
Start frame: 1.000
End frame: 10.000
By frame: 0.000
Skip existing frames
Renumber frames
Renderable Cameras
persp
Close


Render Settings (masterLayer)
Edit Presets Help
Render Layer masterLayer
Render Using Arnold Renderer
Common Arnold Renderer System AOVs Diagnostics
Path: /Users/sraaf1/Desktop/In_Class_Demo/Sabrina_Project_Flythrough_Test/images/
File name: masterLayer/untitled_0001.png
To: masterLayer/untitled_0010.png
Image size: 960 x 540 (13.3 x 7.5 inches 72.0 pixels/inch)
File Output
File name prefix: (not set; using scene name)
Image format: png
Format int8
Output Padded
Dither
Color Space Use View Transform
Frame/Animation ext: name_#.ext
Frame padding: 4
Use custom extension
Extension:
Version Label:
Frame Range
Start frame: 1.000
End frame: 10.000
By frame:
persp
camera1
front
side
top
Add Renderable Camera
Renumber frames
Start number:
By frame:
Renderable Cameras
Renderable Camera persp
Alpha channel (Mask)
Depth channel (Z depth)
Close

### Renderable Camera

Set the correct camera as **Renderable**.

Never use the **perspective** camera for final renders. Use a dedicated render camera and name it clearly (example: `RenderCam_WideAngle`).

1. Choose the camera you want to use for rendering.
2. If your scene contains several cameras, make sure the correct one is enabled.
3. Remove unwanted cameras from the renderable list using the trash icon. (You can add cameras back in using the camera dropdown.)
4. **Uncheck alpha if not needed;** (*saves on rendering time*!)

### Set the output resolution

Locate Image Size. Select a resolution preset. Choose the resolution based on the final output you need. **For example:**

| Preset | Dimensions |
|---|---|
| HD 720 | 1280 × 720 |
| HD 1080 | 1920 × 1080 |

## Part 3: Arnold Rendering Tab

*Open the Arnold Renderer tab in the Render Settings window..*

### Adjust Sampling Settings to reduce noise + blotchy lighting

Sampling controls how many calculations Arnold performs to estimate lighting and shading. Increasing samples generally reduces noise, but also increases render time. Arnold images & examples

- Check render settings for production quality without inflating render times. For Arnold, keep Camera (AA) sampling modest (2–4 is typical for production); adjust Diffuse/ Specular/ etc. as needed. Set SSS to 0 if you have no subsurface scattering.

| Sampling setting | What it controls | Start Value |
|---|---|---|
| Camera (AA) | Overall sampling quality; affects other sampling calculations | 2 or 3 |
| Diffuse | Noise in indirect diffuse lighting and shading | 2 |
| Specular | Noise in reflections and highlights | 2 |
| Transmission | Noise in transmitted light, such as through glass | 1 |

How to adjust sampling:

1. Render a test image.
2. Examine the image for graininess or noise.
3. Identify where the noise occurs.
4. Increase the samples for that particular component.
5. Render another test to check whether the noise improves.

Examples:

- Noisy indirect diffuse shading → Increase Diffuse Samples.
- Grainy reflections → Increase Specular Samples.
- Noisy frosted glass → Increase Transmission Samples.

Important: Avoid increasing Camera (AA) samples excessively. Camera sampling affects the other sampling calculations, so raising it can ***dramatically*** increase render time.

Instead, adjust the particular sampling setting causing the problem, while keeping Camera (AA) at a reasonable value.

**Imager: Arnold DeNoiser (**Arnold Denoiser (noice))

Make sure that Arnold Denoiser (noice) is loaded in the Imager section at the bottom of the Arnold render tab. For more information, see: Imager Arnold Denoiser - Arnold User Guide

## Adjust Ray Depth Settings (see Arnold Ray Depth documentation for detailed settings)

Scroll to Ray Depth under the Arnold Renderer tab. Ray Depth controls how many times light rays can bounce, reflect, or pass through surfaces during rendering. Unlike Sampling, which primarily affects noise, Ray Depth controls how light can interact with the scene.

## Check the Total Ray Depth

The Total setting limits the combined number of ray interactions.

For example, if Total is set to `10`, a ray cannot exceed 10 combined interactions, even if the individual depth settings would otherwise permit more.

1. Check your individual Ray Depth values.
2. Make sure Total is high enough to accommodate the interactions your scene requires.
3. Avoid unnecessarily high values, which can increase render time.

| Ray Depth setting | Function |
|---|---|
| Diffuse | Number of indirect diffuse light bounces between surfaces |
| Specular | Number of successive reflections |
| Transmission | Number of refraction/transmission interactions through surfaces |

| | |
|---|---|
| Transparency | Number of transparency interactions |
| Volume | Number of scattering interactions within volumes, such as smoke |
| Total | Maximum combined ray depth |

## Adjust Diffuse & Specular Ray Depth

Diffuse Ray Depth

5. Increase Diffuse depth to allow more indirect light bounces between surfaces.
6. Additional bounces can increase indirect illumination in the scene.

Specular Ray Depth

1. Increase Specular depth when you need reflections within reflections.
2. This is particularly important when reflective objects face one another.
3. If the depth is insufficient, reflections may terminate and appear black.

**Don’t set reflections to be too deep.** Don’t make mirrors that reflect mirrors that refract through glass that reflect off mirrors, etc. Tune the reflection depth to what each scene needs. An extreme example would involve two opposing mirrors, which would require approximately 80 specular bounces to reproduce repeated reflections.

## Adjust Transmission and Transparency Depth

These settings control different interactions with transparent materials.

1. Increase Transmission Depth when refractive surfaces, such as glass, require additional light interactions.
2. Increase Transparency Depth when rays need to pass through multiple transparency surfaces.
3. If surfaces unexpectedly appear black, check whether the appropriate depth limit is too low.

Remember that objects with thickness generally have at least a front and back surface, so a ray may need multiple interactions to pass through them.

## Adjust Volume Ray Depth

Use Volume Ray Depth when your scene contains effects such as smoke or clouds.

1. Increase Volume depth when additional scattering interactions are necessary.
2. Higher values can allow more light scattering within a volume.
3. If your scene does not contain volumetric effects, the tutorial recommends leaving Volume depth at `0`.

# Submit to Flow Render

**Flow Render** is Autodesk's cloud rendering service built into Arnold. It uploads your scene, renders it on cloud machines, and sends the frames back — so your own computer stays free. It launched as a tech preview with free monthly render time for subscribers (40 hours per month at launch); check your account for your current allowance.

1. **Save** your **render** version of the scene (Part 2.6).
2. Open the **Arnold** menu > **Flow Render** > **Submit New Job** (also on the Arnold shelf). If there is no Flow Render menu, load **flowRender** in **Windows > Settings/Preferences > Plug-in Manager** — it ships with Arnold.
3. **Render Layer:** choose **masterLayer**, **All Renderable Layers**, or **Custom** to pick specific layers.
4. **Animation Source:** for an animation, choose **Render Settings** (uses the frame range from your Common tab), **Animation Range**, or **Custom**.
5. **Override Resolution / Override Camera:** leave off unless you need to — your Render Settings are used otherwise.
6. **Job Name:** give it a name you will recognize, e.g. `LastName_Project_v03`. Tokens such as `<SceneName>`, `<RenderLayer>`, and `<Camera>` can be added.
7. **Frames Per Task:** keep the default (**1**) unless each frame renders in seconds. Leave **Frame Time Limit** at **0** (no limit).
8. **Auto Download:** turn on to have frames download automatically when the job finishes — by default into your project's `flow_render_images` folder. Files with the same name are **overwritten**, which is another reason to version your file name prefix.
9. Make sure your **Units are set to Centimeters** inside of Preferences -> Settings
10. Click **Submit**. The **Flow Render Monitor** opens and shows the upload. Only one submission uploads at a time; others wait under **In Queue**.

> WATCH OUT · **Animation Source defaults to Current Frame**
>
> If you leave it on the default, Flow Render renders **only one frame**. Double-check it on every submission.

## 1 Monitor and download

- Select your job in the **Flow Render Monitor** to see its progress, a render preview, and the render log. You can also check jobs in a web browser at graphengine.autodesk.com with your Autodesk account.
- When the job finishes (if Auto Download was off), click **Download > All** to get your rendered frames and the logs, and choose where to save them. If a file with the same name already exists, the new one gets a number added, e.g. `myimage_(1).exr`.
- If a job fails because of missing assets, fix the paths and resubmit with **Advanced Options > Force Upload Missing Files** turned on.

### 2 Flow Render limitations

| Limitation | What it means for you |
|---|---|
| Up to **10 tasks** run at the same time | Long animations still take time; submit early |
| Jobs **can't be prioritized** | Jobs run in the order submitted |
| `<attr>` token in texture file names not supported | Use regular file paths for textures |
| **XGen** and **Bifrost** have some limitations | Test a few frames before submitting the whole range |
| **Third-party Arnold plug-ins** (e.g. Yeti) not supported | Use built-in Maya/Arnold tools for anything that must render |

## Check Your Results

1. **Count the frames.** The number of files should match your frame range, with no gaps in the numbering.
2. **Check file sizes.** A frame that is much smaller than the rest is often black or failed.
3. **Play the sequence back.** In Maya use **File > View Sequence**, or import the image sequence into After Effects, Premiere, or DaVinci Resolve.
4. **Look for problems:** flicker, missing textures, black reflections, jittery cloth or hair, wrong camera.
5. **Keep your render version and frames** together, and never render a new version over an old one.

## FINAL CHECKLIST

Before rendering check these settings:

In Common Tab

- ➢ Correct image format selected
- ➢ Naming is configured for still image or image sequence
- ➢ Frame padding and frame range set
- ➢ Correct renderable camera enabled. Alpha disabled unless needed
- ➢ Output resolution selected

In Arnold Tab

- ➢ Camera (AA) and other sampling values checked
- ➢ Diffuse, Specular, and Transmission sampling adjusted as needed
- ➢ Ray Depth settings appropriate for scene materials
- ➢ Total Ray Depth sufficient
- ➢ Test render inspected for noise and missing reflections or transparency
- ➢ Imager - Check that DeNoiser (Noice) is added
- ➢ Reset checklist

## AGAIN! FILE PATH EDITOR

**Verify References, Paths & Render Settings**

- **Use the File Path Editor** to verify that texture and other references are pointing to the proper, relative locations in your project folder. Any lingering references to files on your own desktop (ie, on C:\ or /Users/username/ ~) will cause your render to error! Go to **Windows>General Editors>File Path Editor** to verify that all textures and image files are linked properly. Their paths should look like this sourceimages/image_name.png
- **Click on any line in the File Path Editor that is showing a red x next to it.** That line should be highlighted as light blue. Next click on the RePath button (lower left hand corner). In the pop-up window, browse until you find your project folder and select that folder. Check on the tic-box that says to look in subdirectories. Leave the second box blank. Hit Enter/ Return.

## Main Reasons Render Jobs Fail

**The 5 most common rendering errors in order of frequency**

1. Files and folders located on the local scratch drive rather than on the render drive. This is by far the most common error. Please check your textures to make sure they are in the right location. Incorrect project paths (e.g. C:\ instead of sourceimages/…)
2. Missing project files, especially textures
3. Missing Plugins
4. Bad geometry - Check for issues with non-manifold, lamina, non-planer, etc geometry