VRDC @GDC 2018

Journey to Mission: ISS

MAGNOPUS

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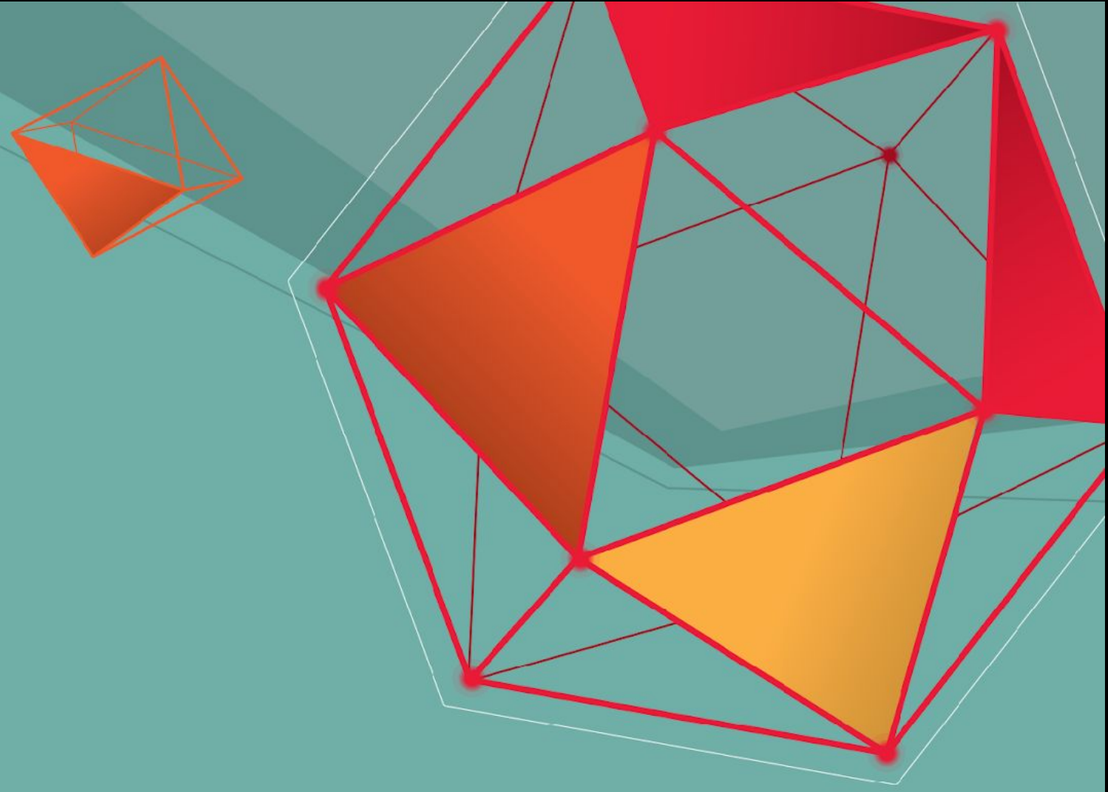
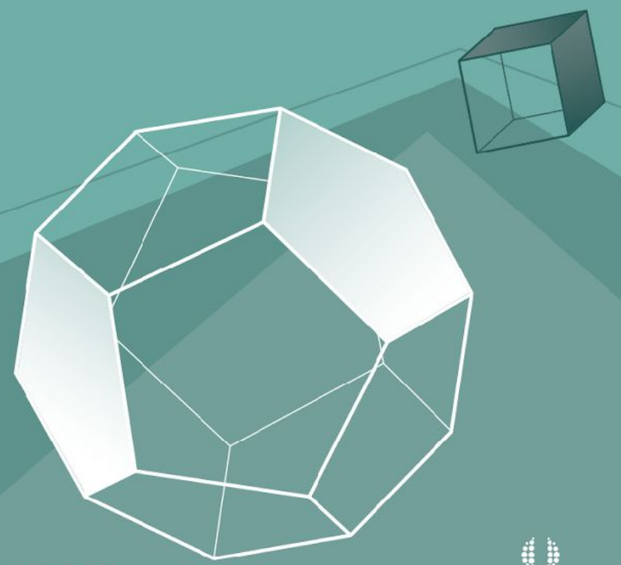




VIRTUAL REALITY DEVELOPERS CONFERENCE | MARCH 19–20, 2018 | EXPO: MARCH 21–23, 2018 #GDC18

UBM

What is Mission: ISS?

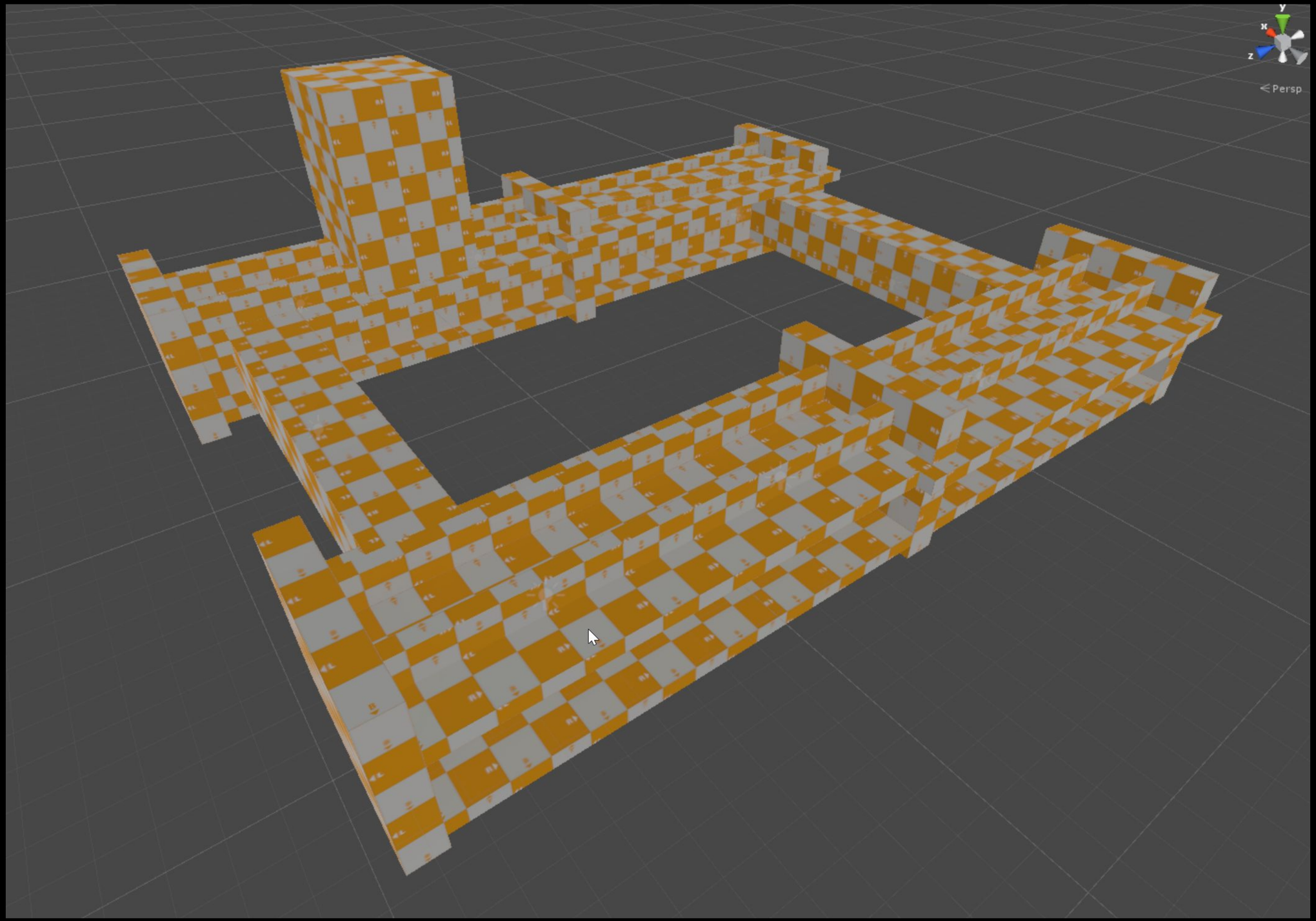
- Accurate interactive VR experience in the International Space Station
- Educational video content
- Fun Zero-G navigation!

Design Philosophy

- Design controls like we're making a game
  - Constraints guide prototyping
  - Prototyping set final focus of experience
- Make it feel as realistic as possible
  - 1 out of 1 astronaut agrees

Greyboxing Principles

- Already know metrics
  - Door size
  - Narrowest gaps
  - Scale
- So use this to determine player metrics


y
x
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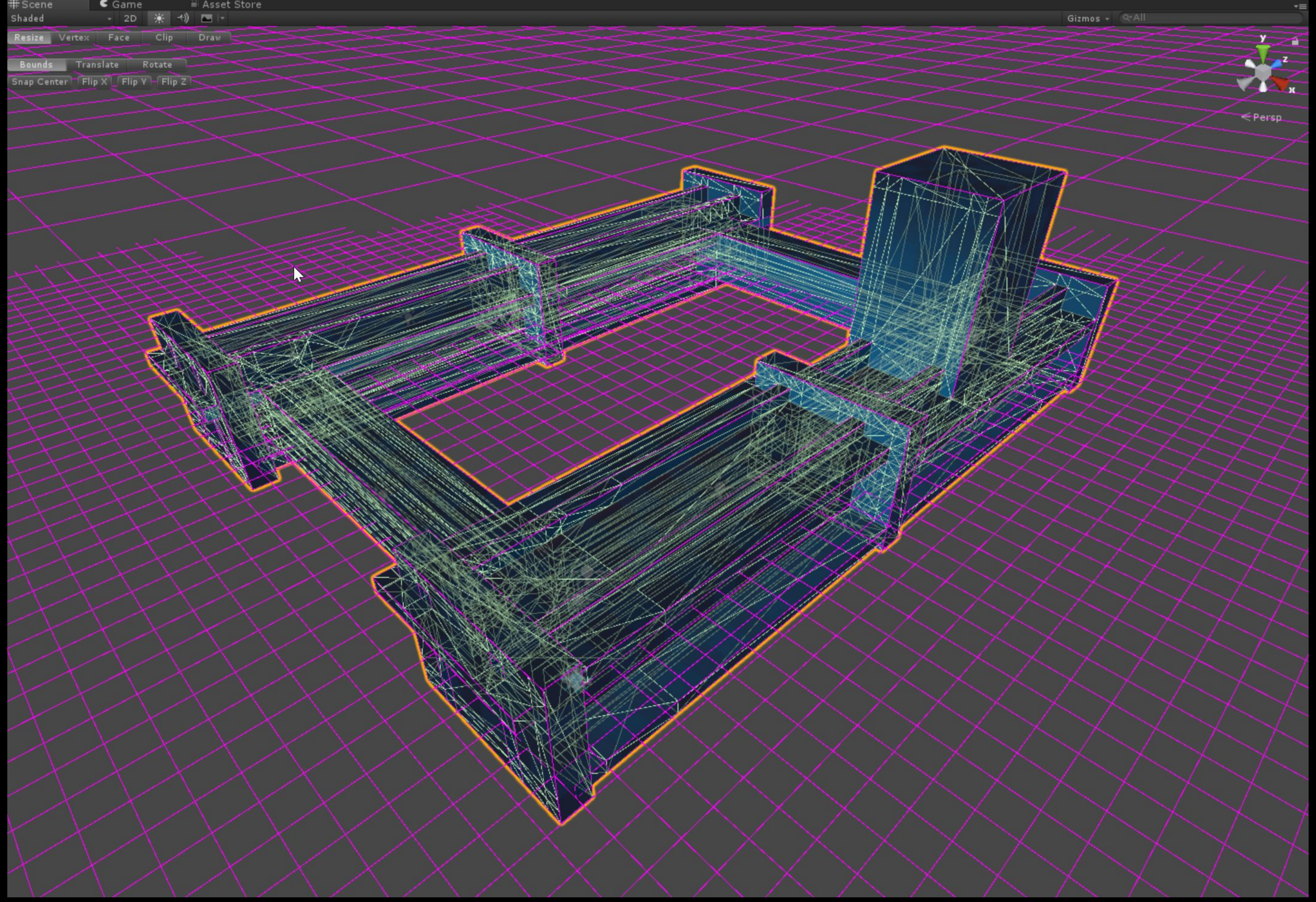
Persp


Scene
Game
Asset Store
Shaded
2D
Gizmos
All
Resize
Vertex
Face
Clip
Draw
Bounds
Translate
Rotate
Snap Center
Flip X
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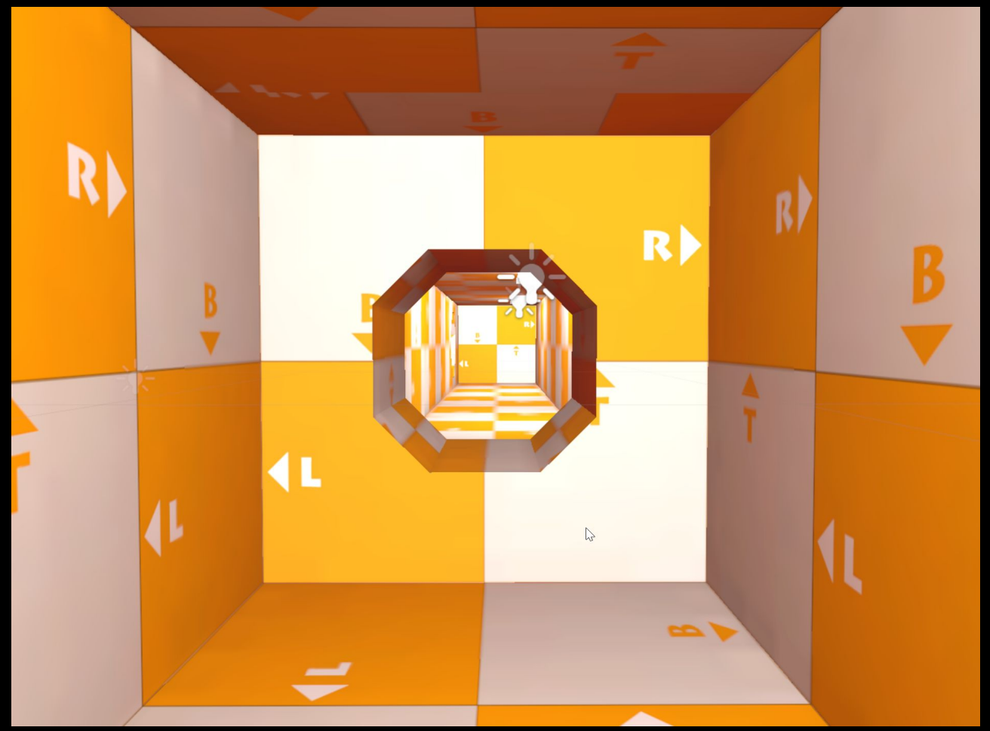
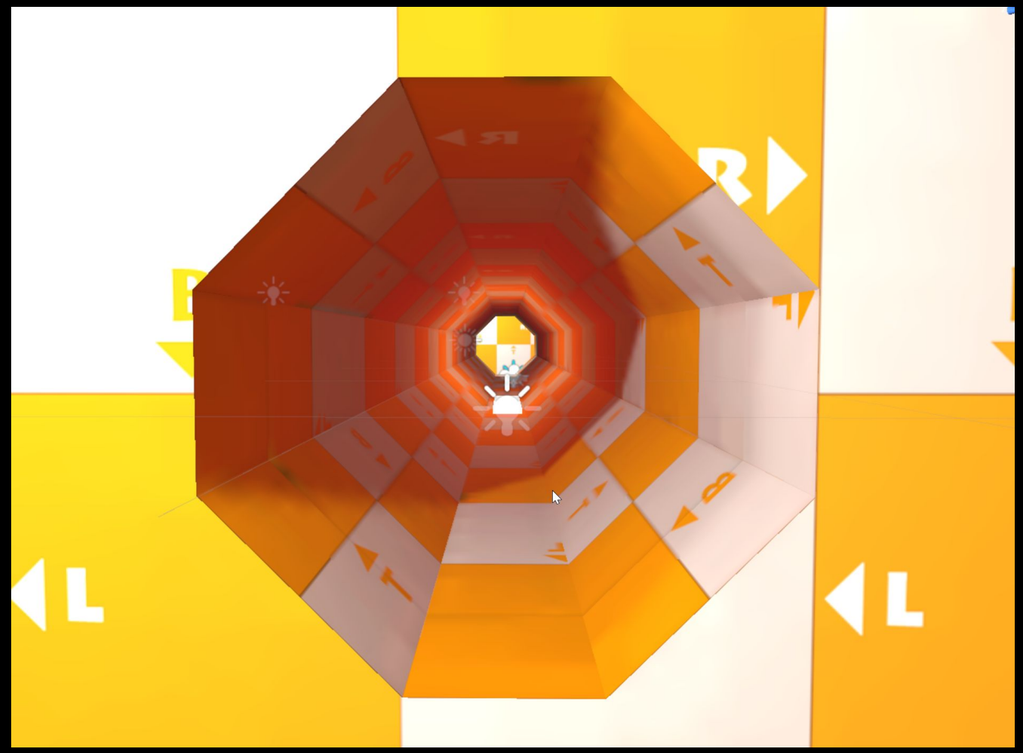
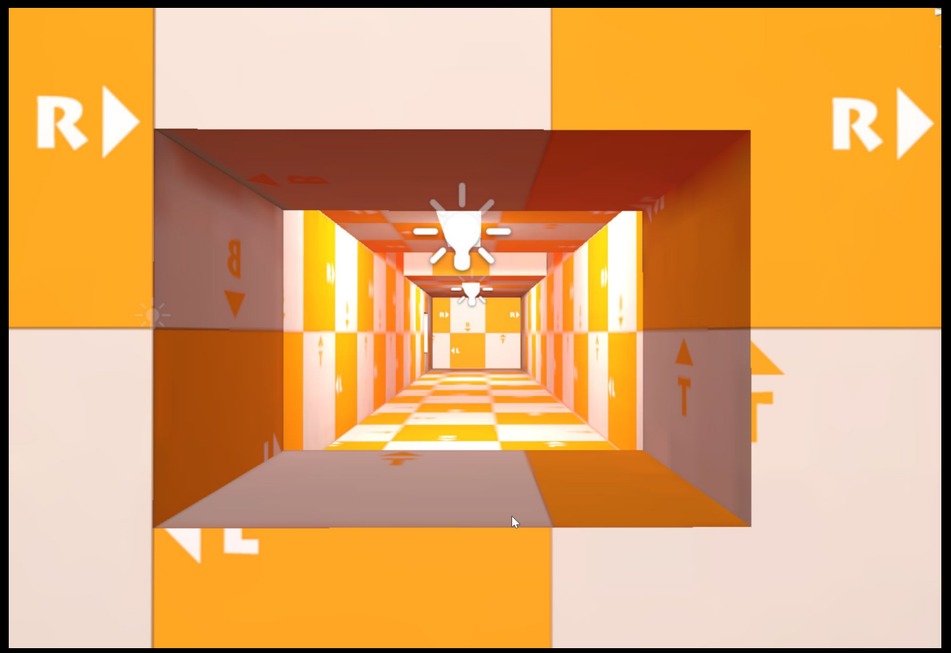
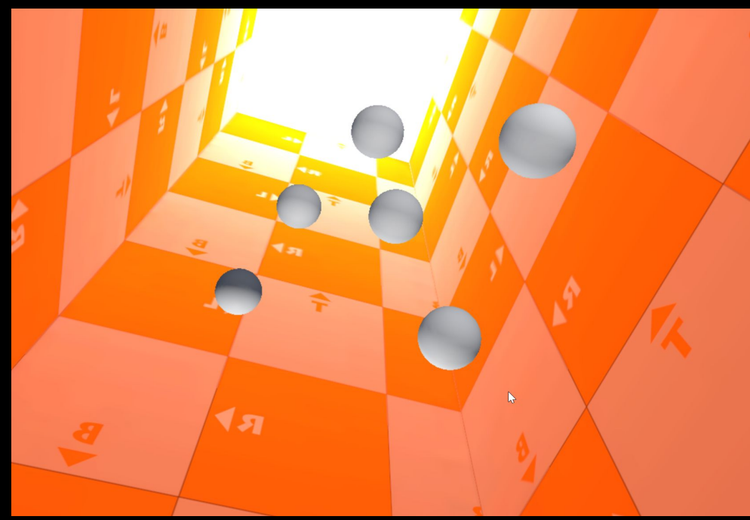








Visual Development of the Interior

Balancing art, realism and performance.

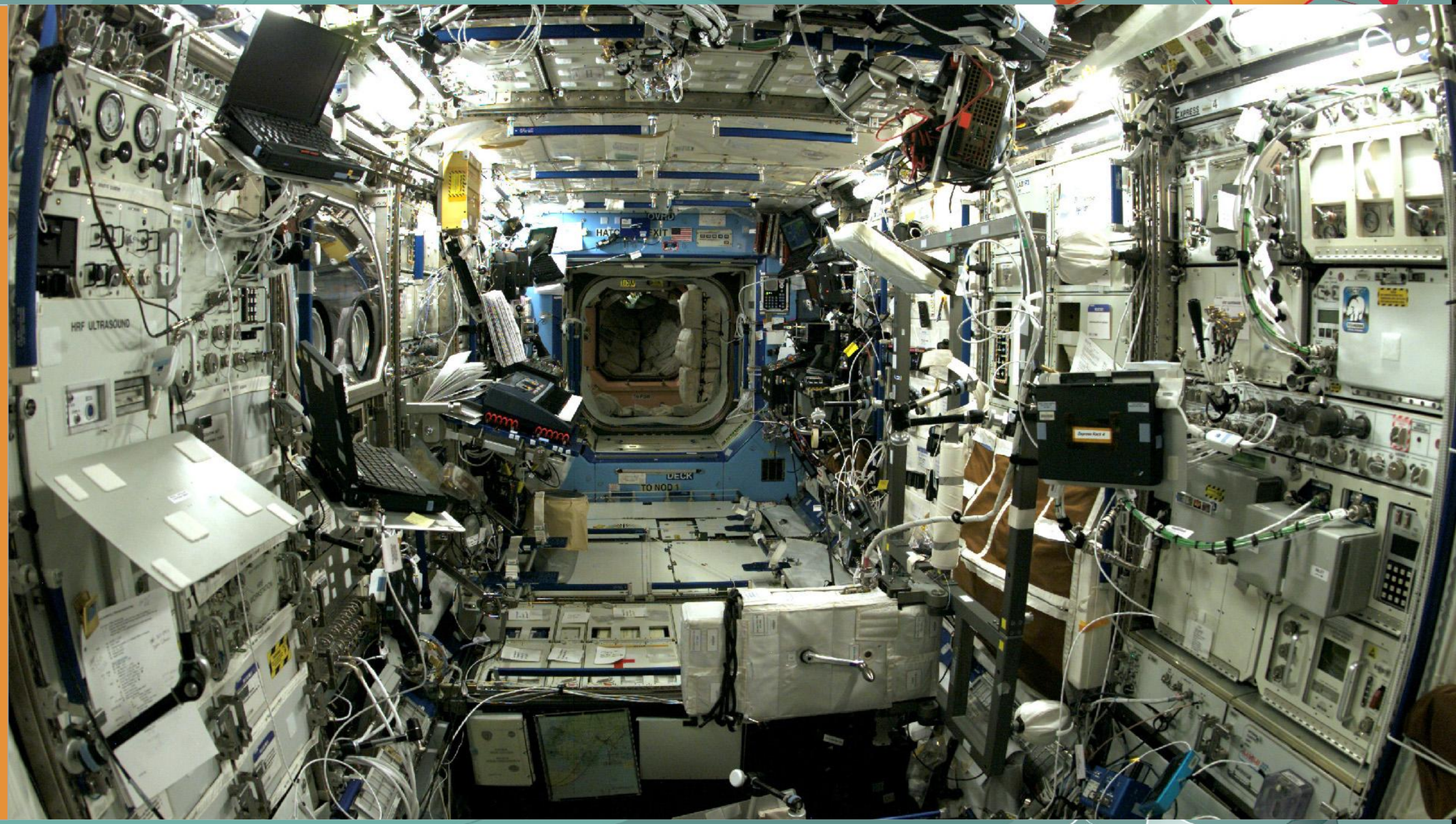
Goal

-identify key elements that define the space.

-structure the elements in a coherent way.

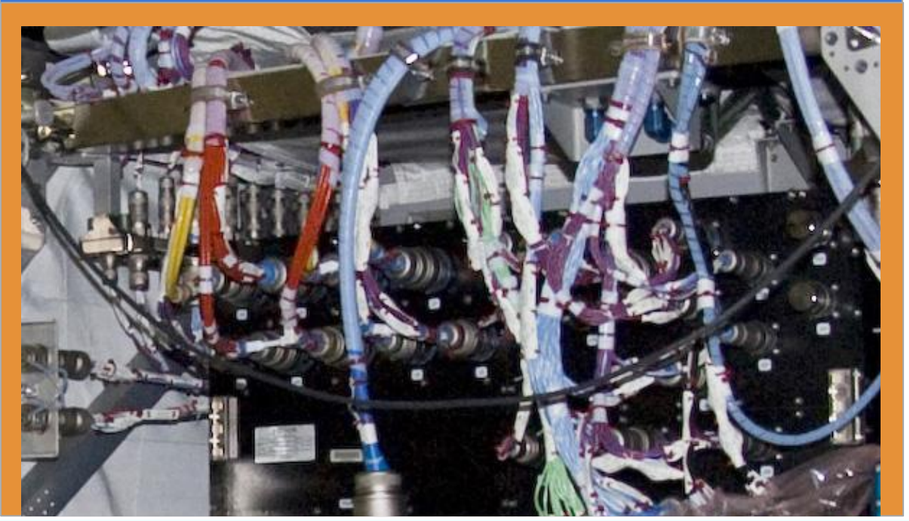
-don't tire out the player's eye.

-keep framerate in mind.

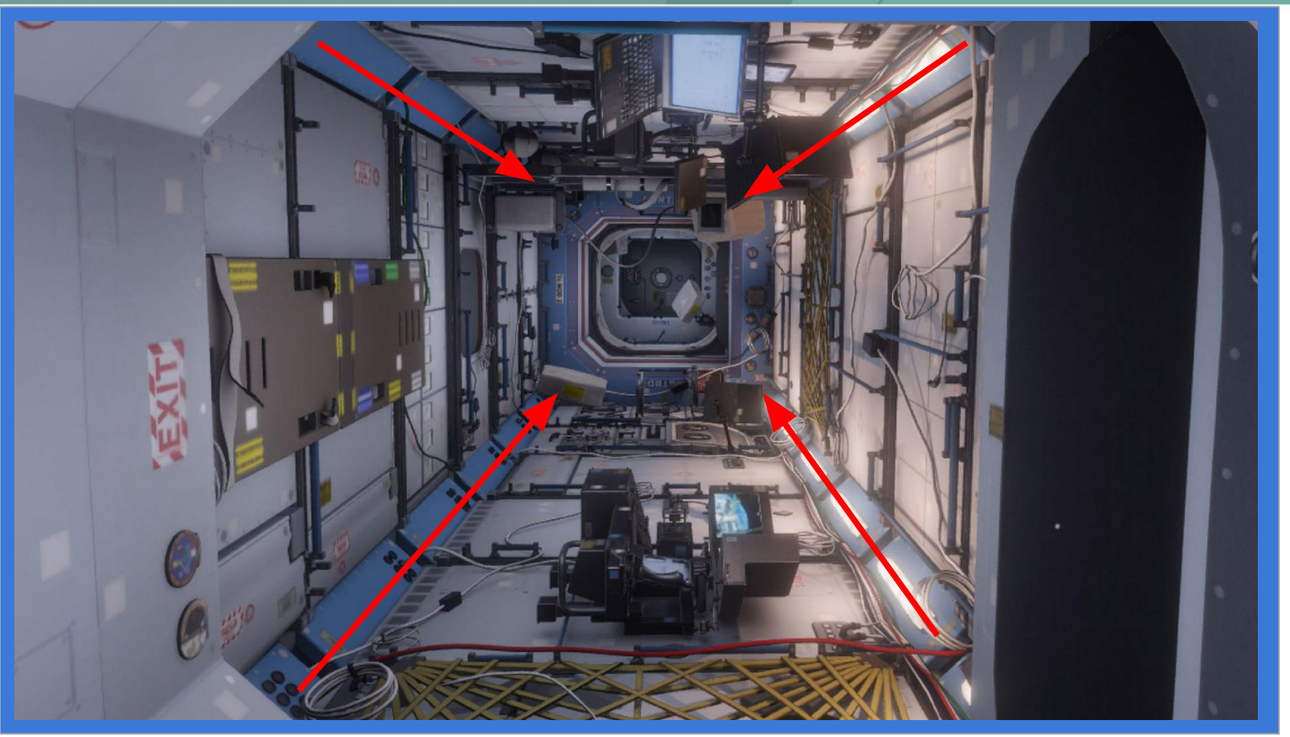


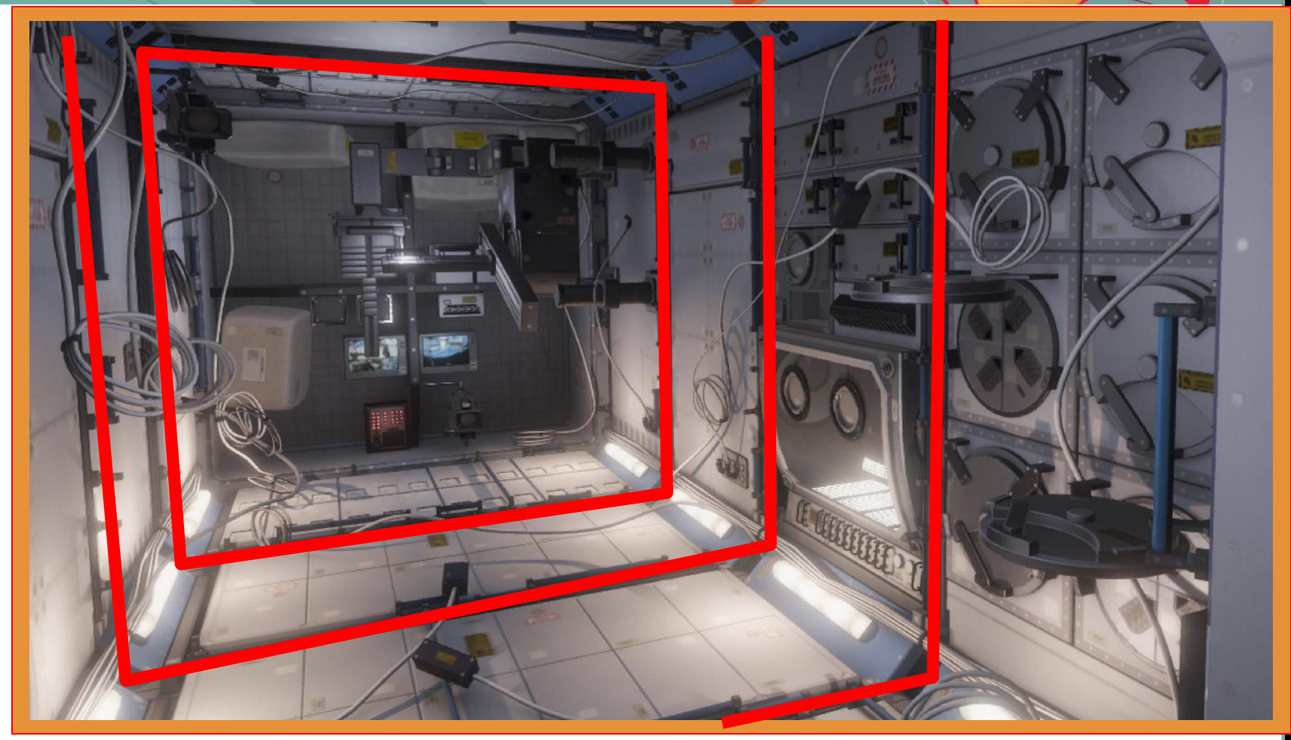
Capture the spirit of the interior

-Larger objects with simple shapes.
-Object colors contrast with the background wall color to make them more legible.



-Objects that seem to pop out of every corner of the environment...Wires!

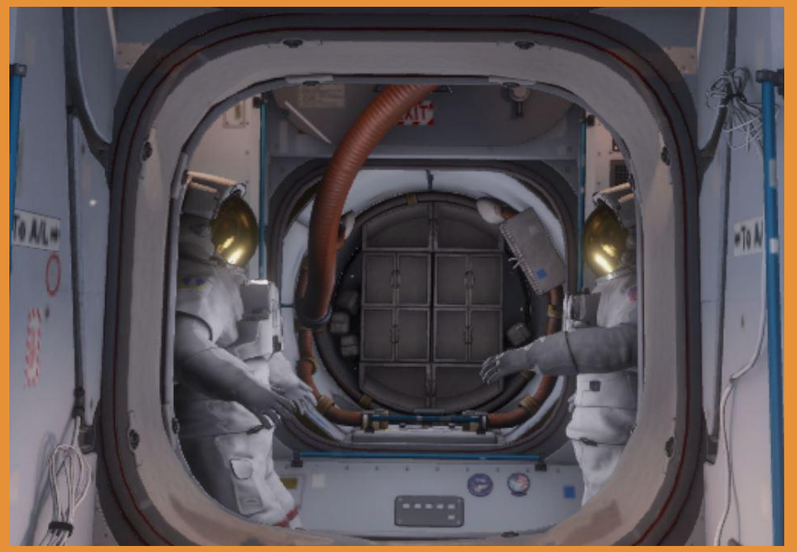




-Keep some areas thick with clutter, try to keep the clutter definable.
-Create empty areas where the player can rest their eyes.
-Module structures create compositional frames, lines that can help guide the players eye through the scene.
-Make the wires thick, visible from a distance. Reduce wire braids down to single wires to help performance.
-Blue sections break up the whites and greys, adding more visual interest.

Keep users oriented

-Structures at the end of each module are easily identified.

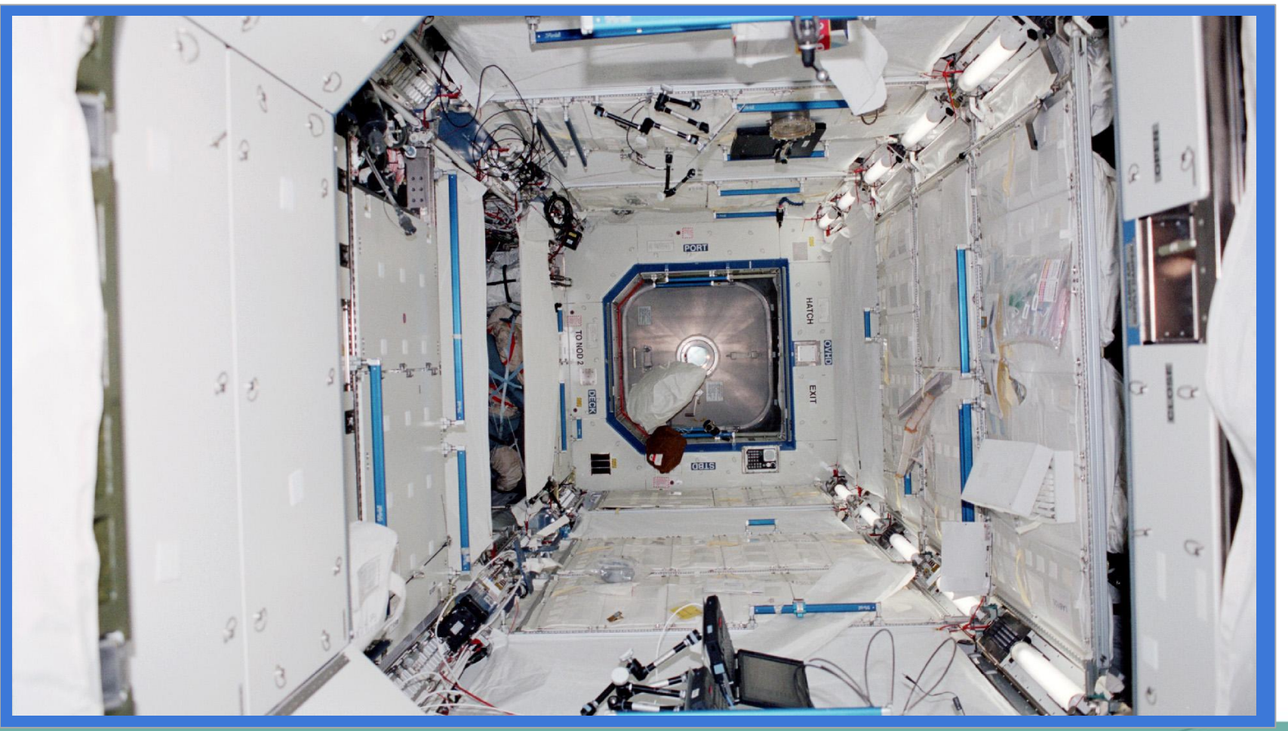


Destiny Module just after installation

-Lighting is great for working astronauts, however…

-Whites overwhelm the visual composition.

-Very bright for the player.



Our Destiny Module

-Warmer, more comfortable tones.

-More falloff on the lights, visible contours for the eyes to follow.

-Easier on the eyes of the player.

Visual Development of the Exterior

How to make the experience memorable.

-Dramatic lighting that feels appropriate to the environment.

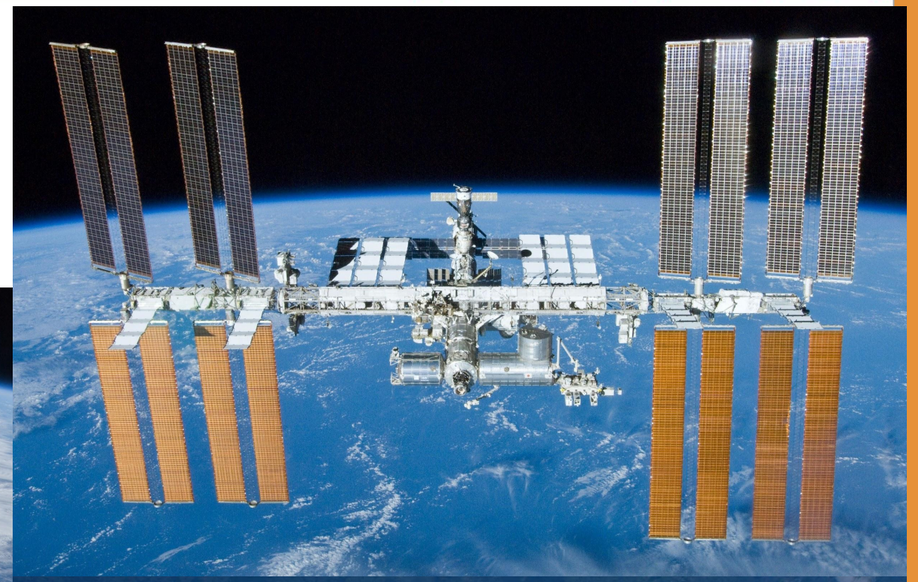
-Highlights bring out extra details.

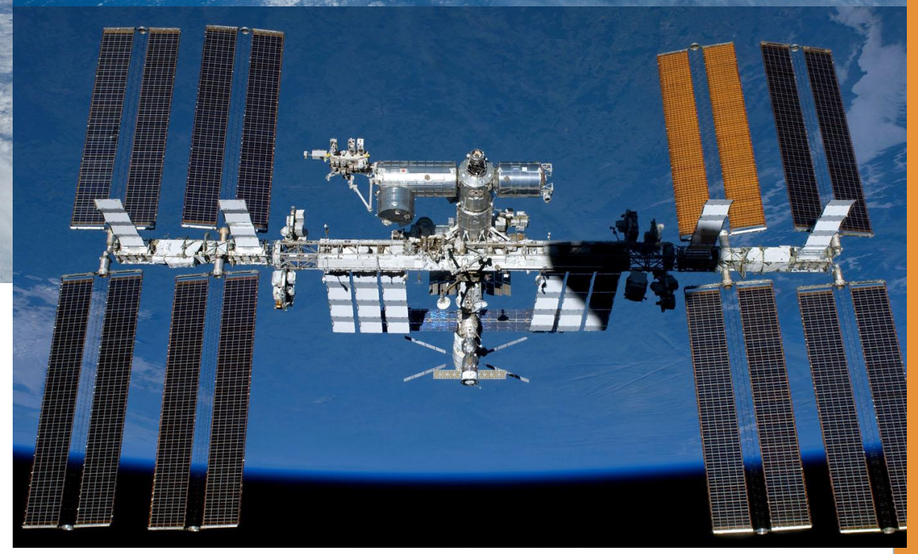
-Objects are still visible in the shadows.

Reference Images show a strong 1-point lighting scheme

Positives

-Strong shadows bring more dimensionality (show where modules lie in relation to one another) to the station and add character to the otherwise flat areas.



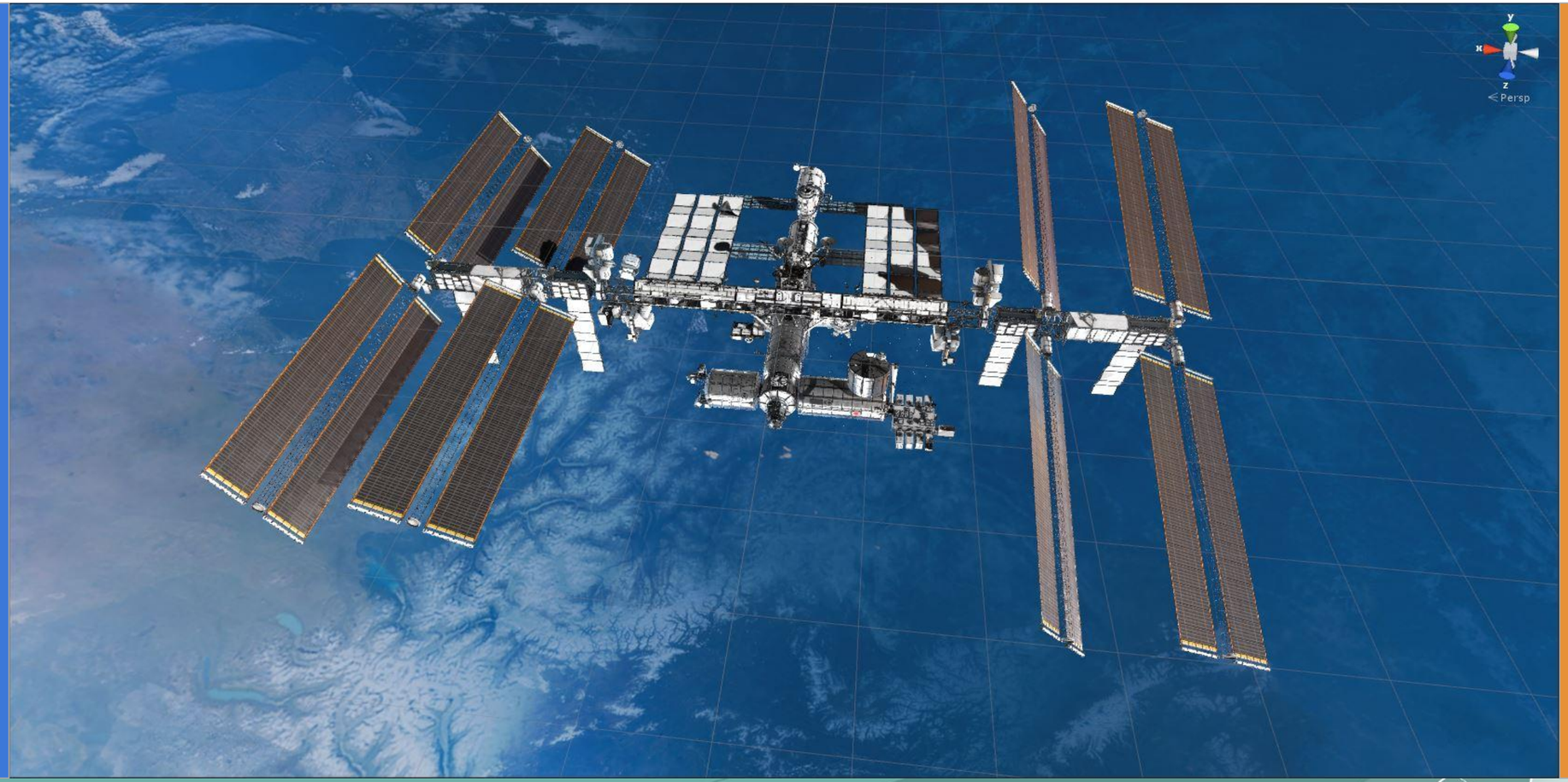


Negatives

-Bright whites are too harsh for the vr player.

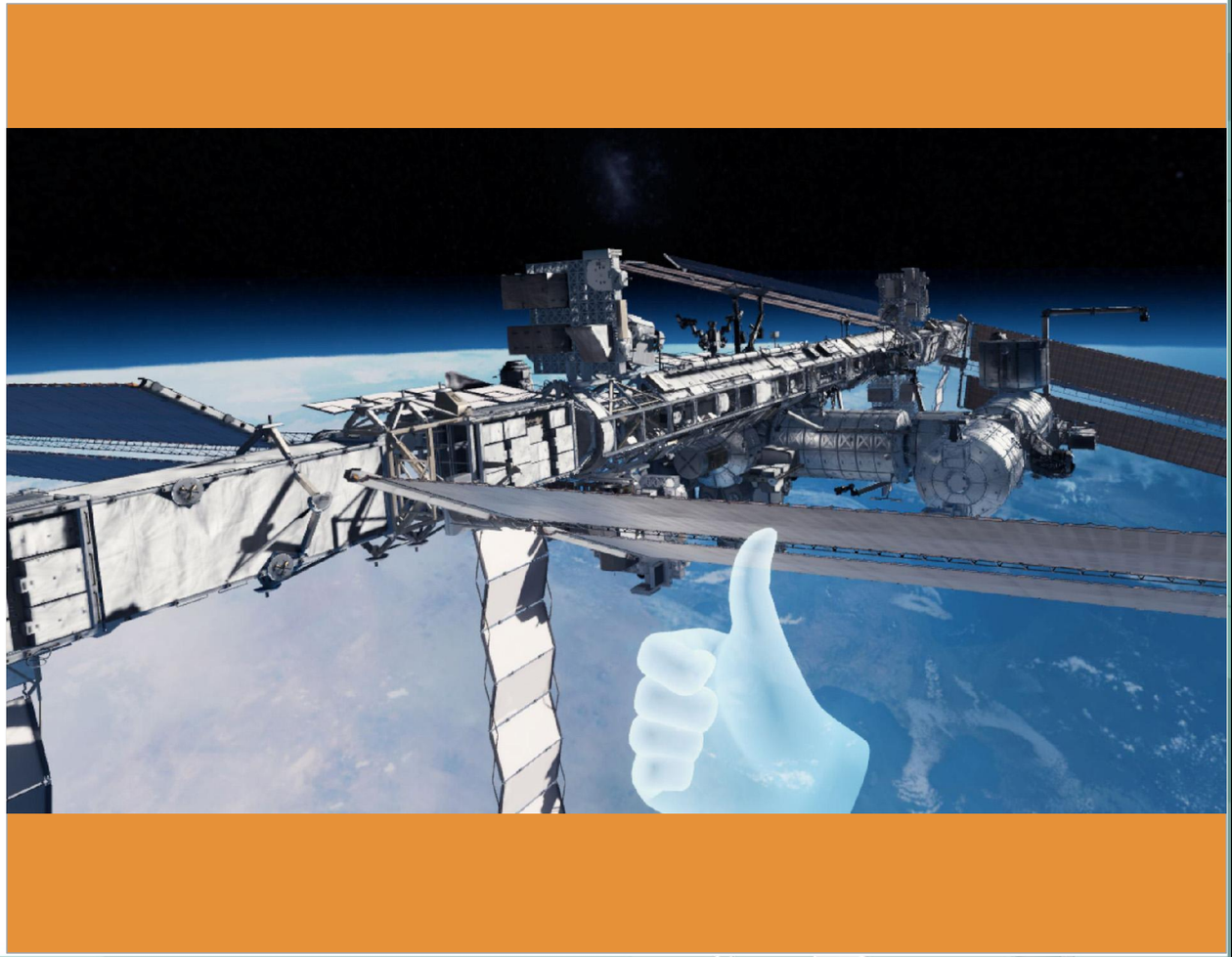
-Dark shadows obscure small details.

Find a lighting angle that makes the station interesting from as many angles as possible.



Surfaces blow out in the reference images.

Adjust light values to keep detail in highlights and shadows.

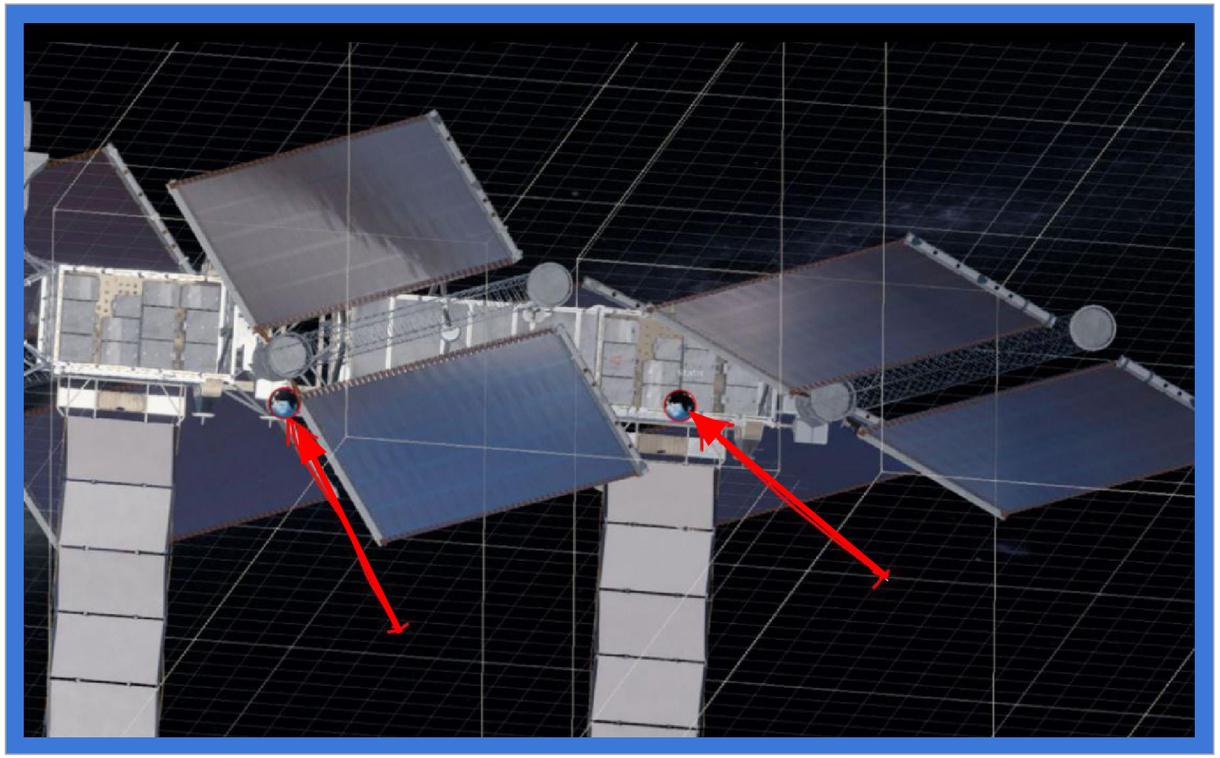


Reflections

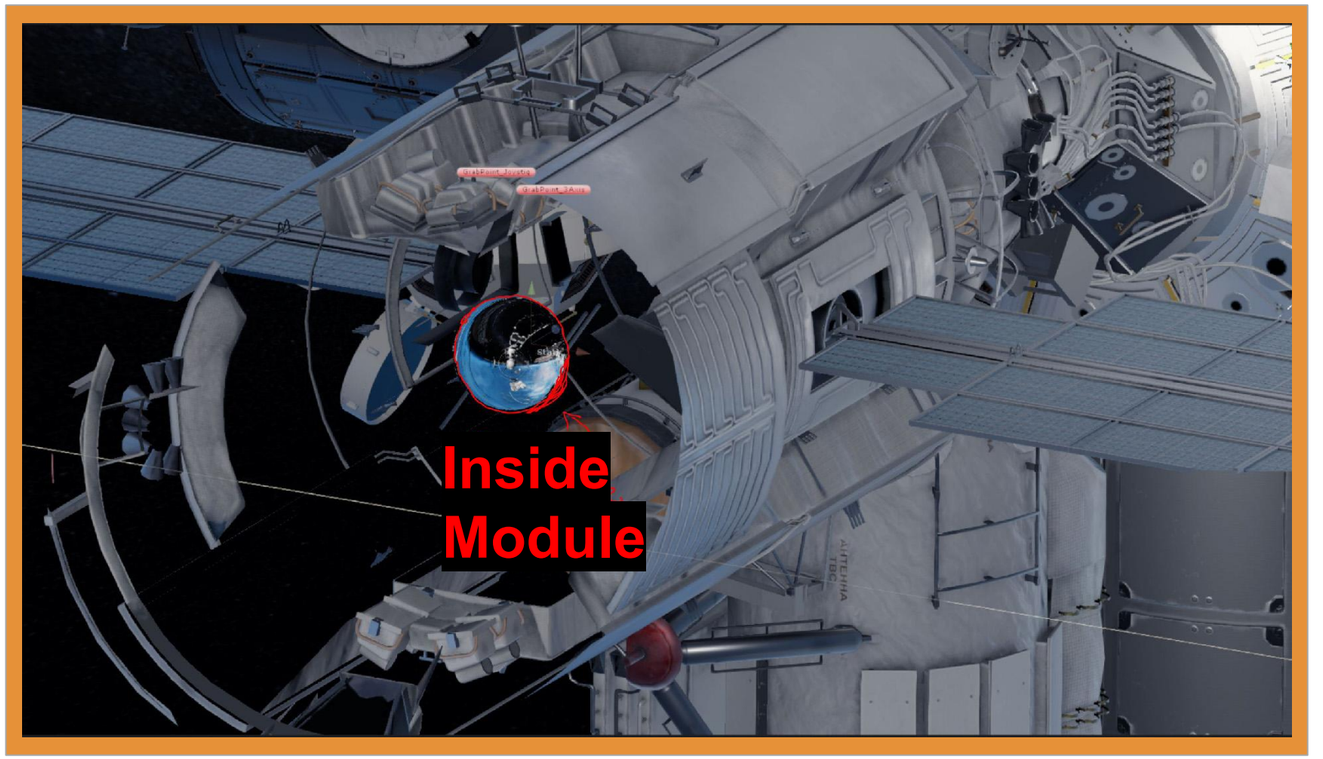
-Emphasize reflections from the earth and other parts of the station.

-Avoid reflecting the blackness of space.

Place the solar panel reflection probes close to the truss.

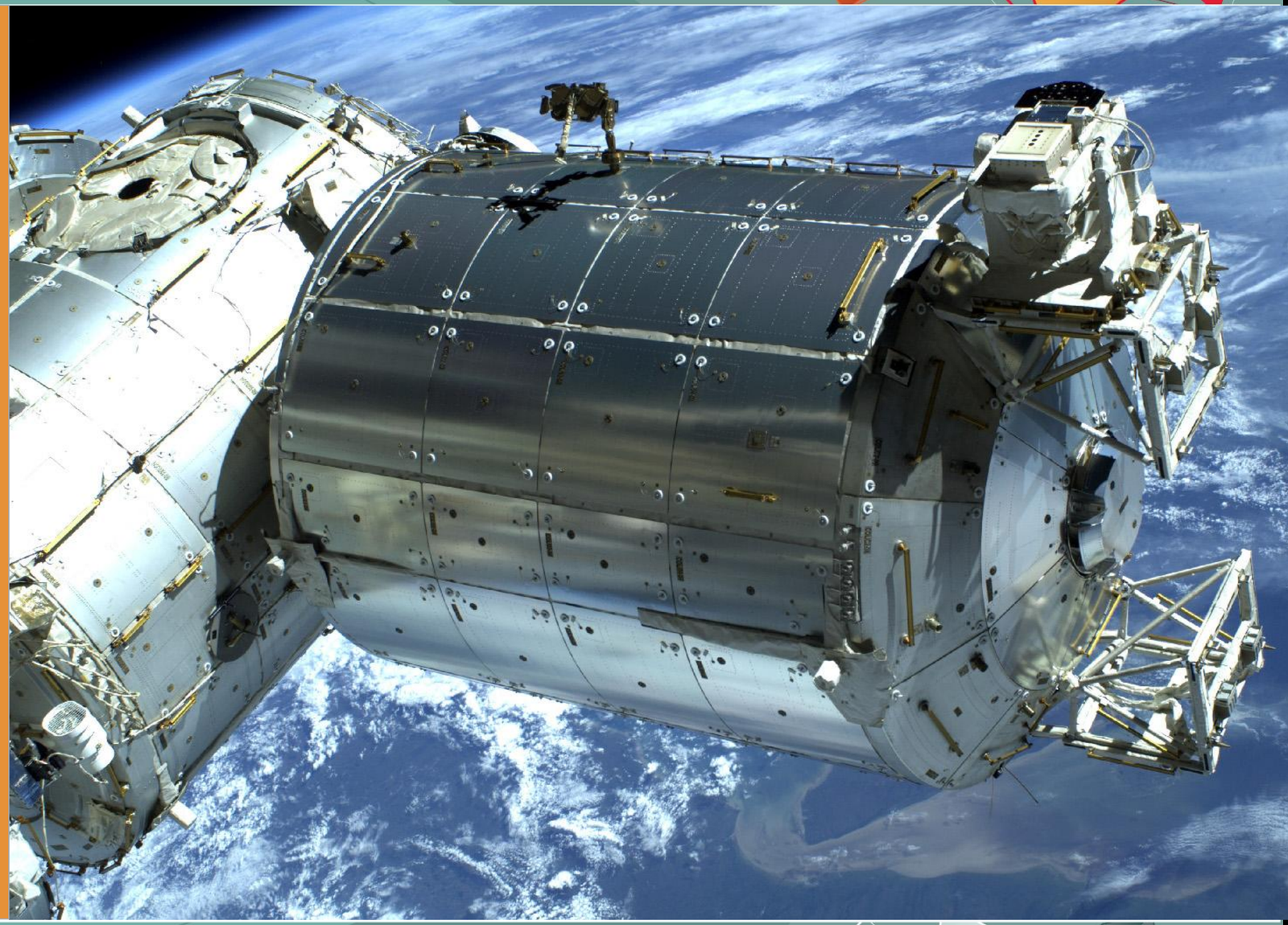


Single sided mesh allows us to place probes inside the modules.



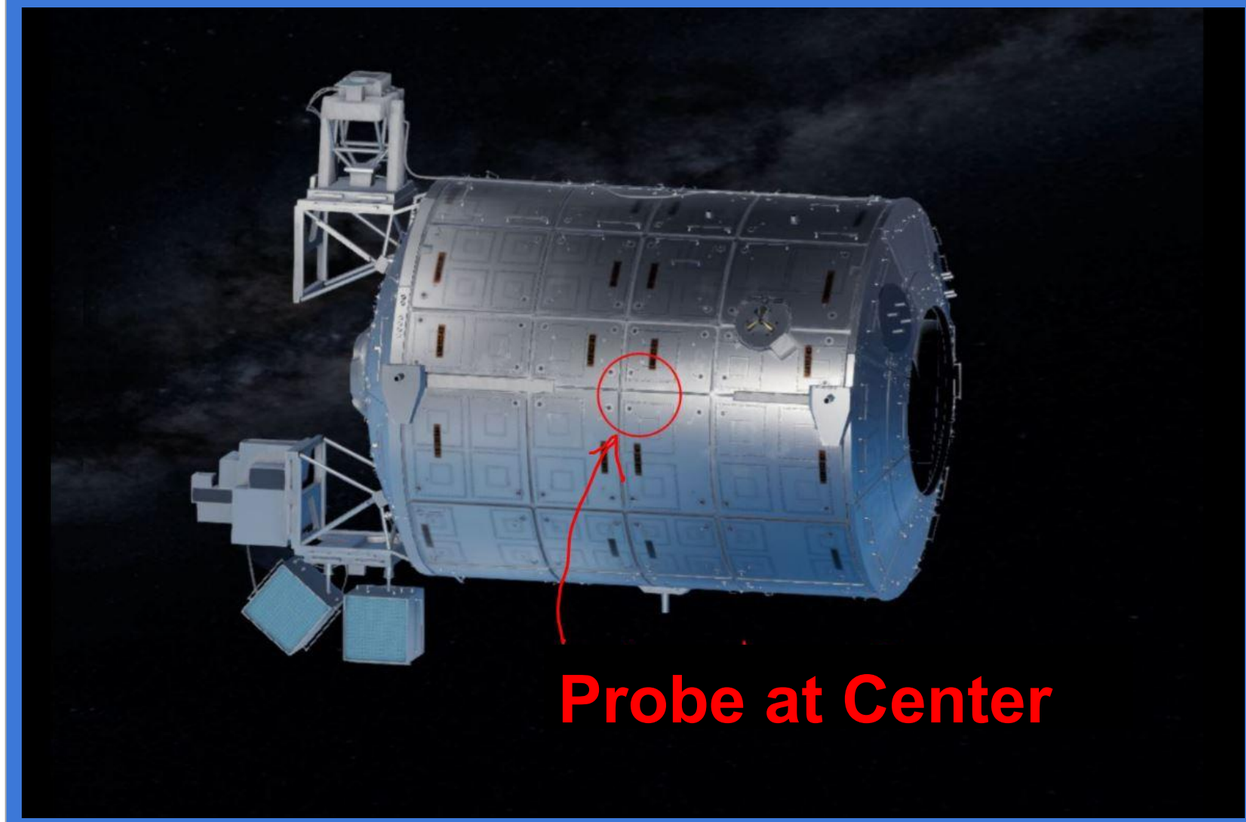
Reference Image Conundrum

-Reflections still feel like they are reflecting something interesting on the black starfield side.



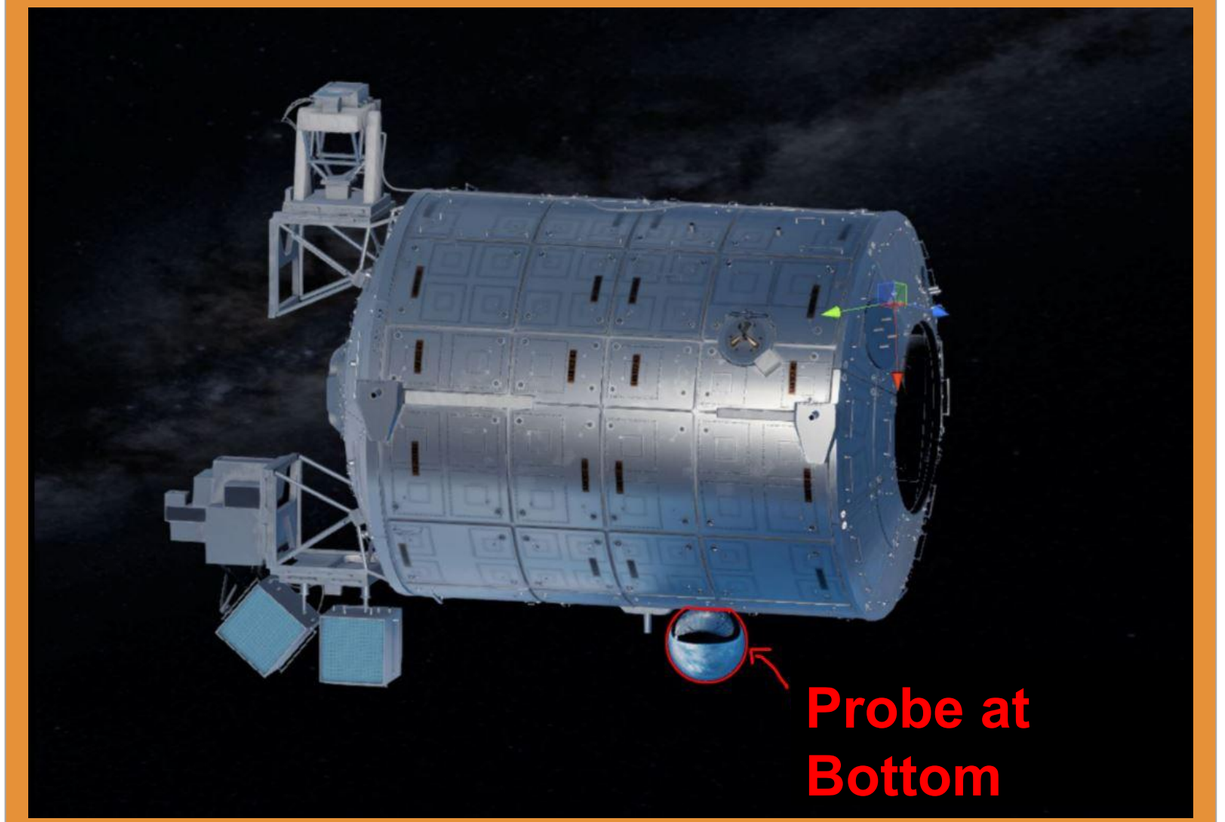
Probe at Center

-Reflection feels dead on the starfield side.



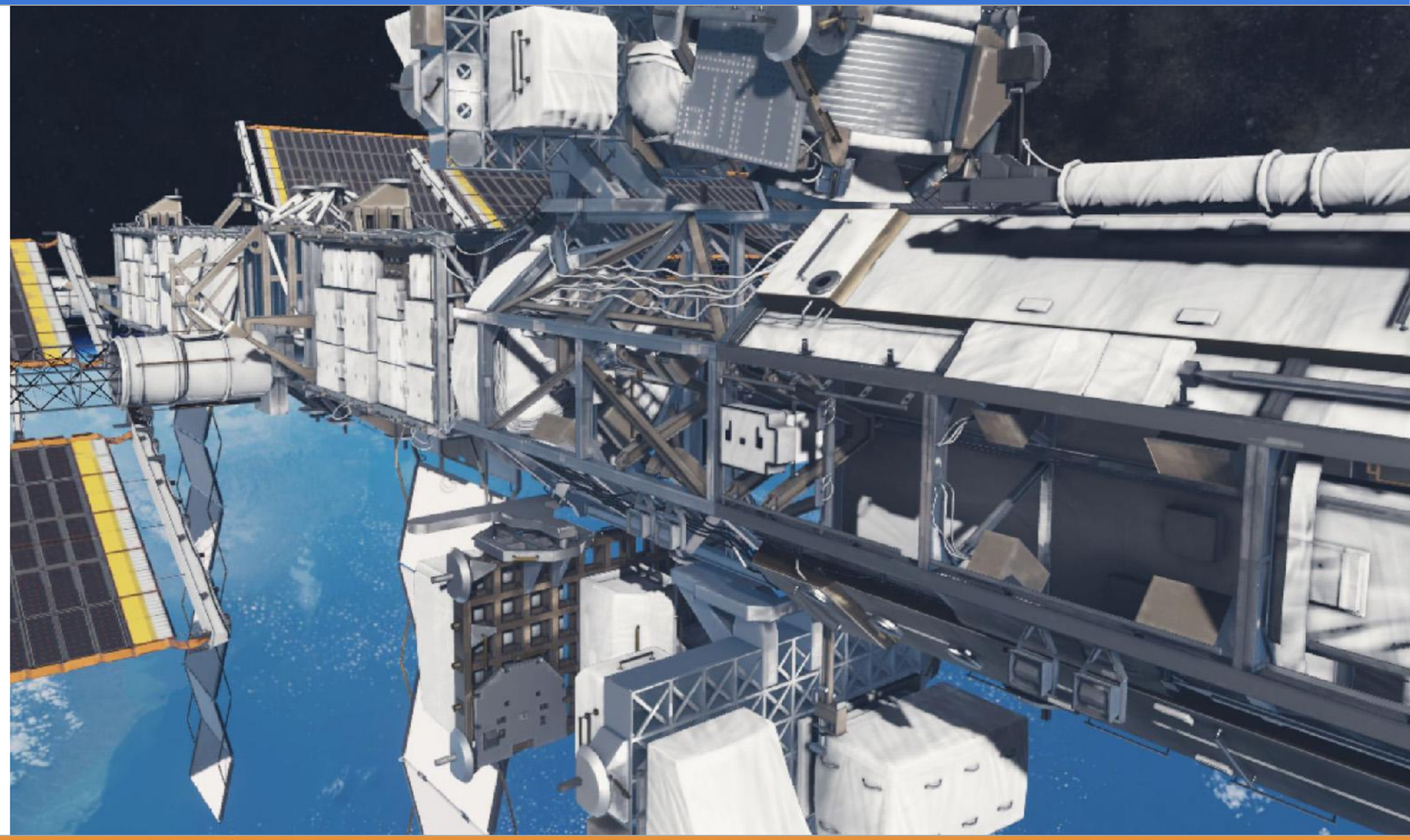
Probe at Bottom

-More life in the starfield reflection.



Reduce tiling along the truss

-scale and rotate uvs of the individual elements to avoid a tiled look.



Post Process

We could afford:
-Fast Approximate AA
-Bloom

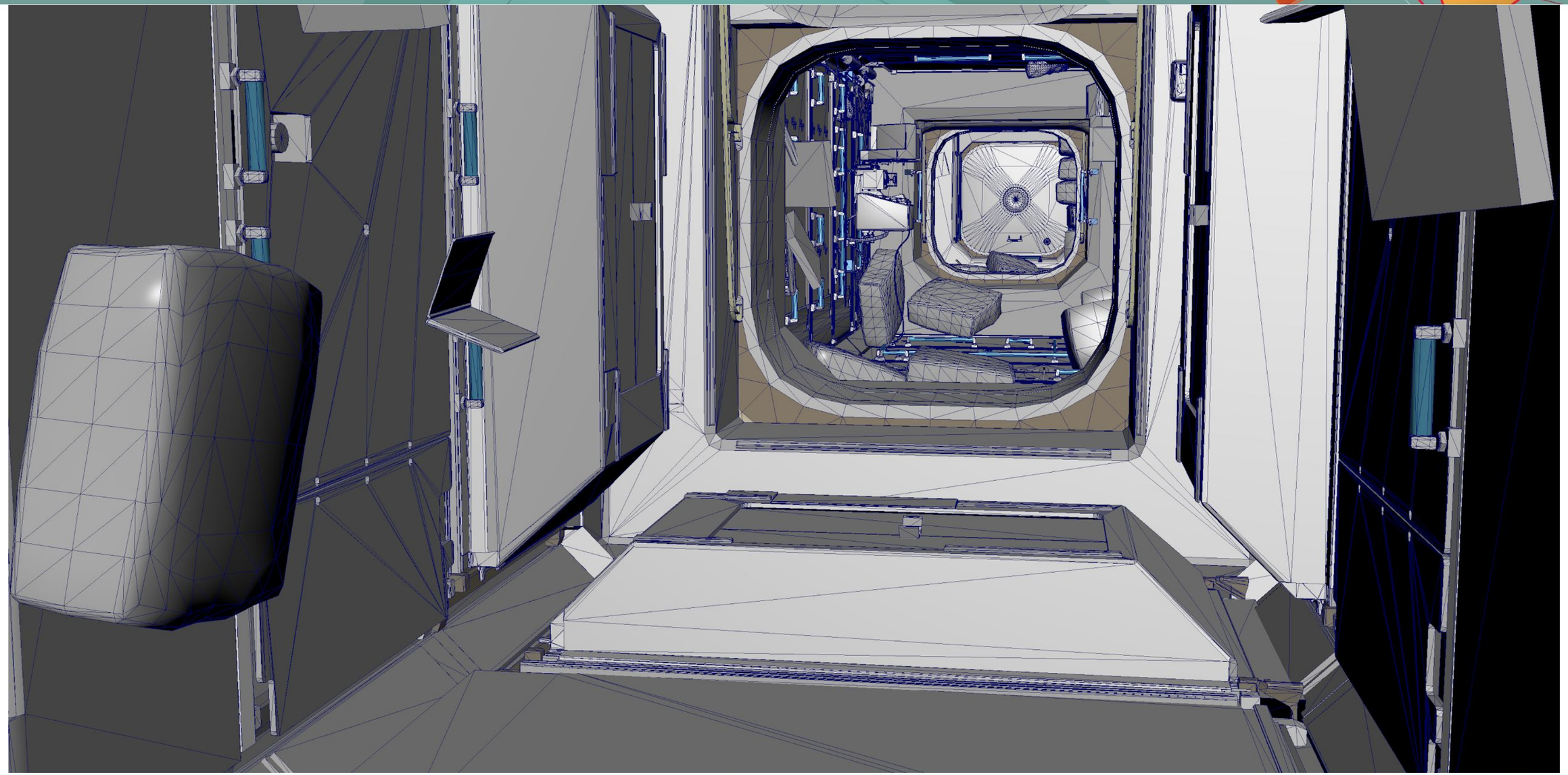
Too expensive:
-Ambient Occlusion
-Screen Space Reflections

Hard Work

Building the ISS

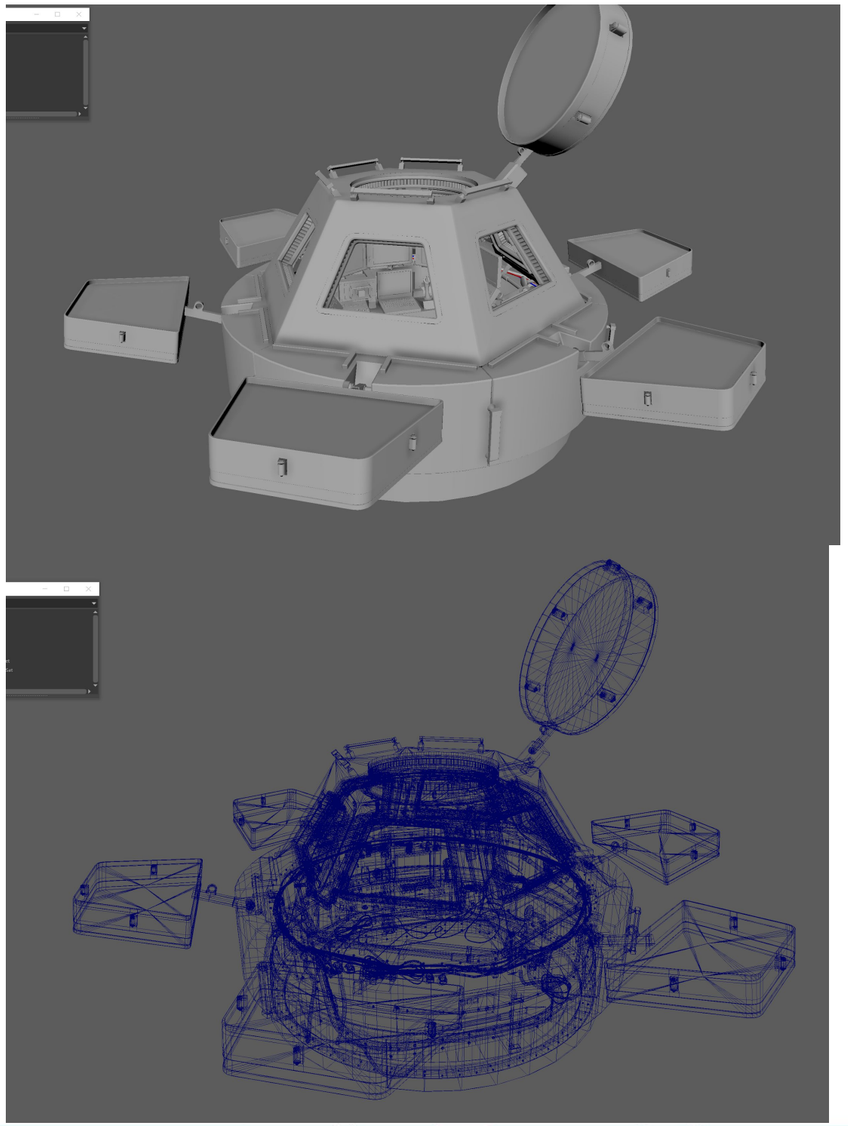
Building the ISS

- Source Models
- Interior/Exterior posed different challenges
- Goal: Highest quality space station in VR



ISS Interior

- Cupola was the starting point
  - Most complex module
- Final stats: 200k triangles, 12 materials, 30 textures

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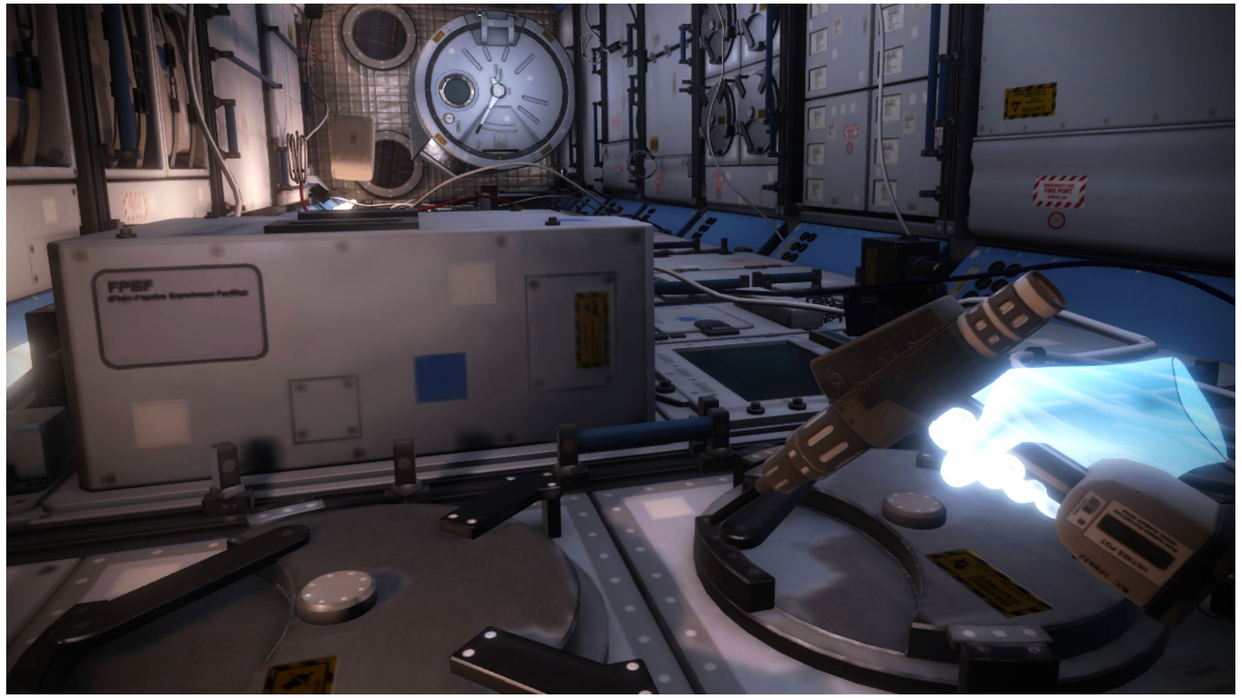
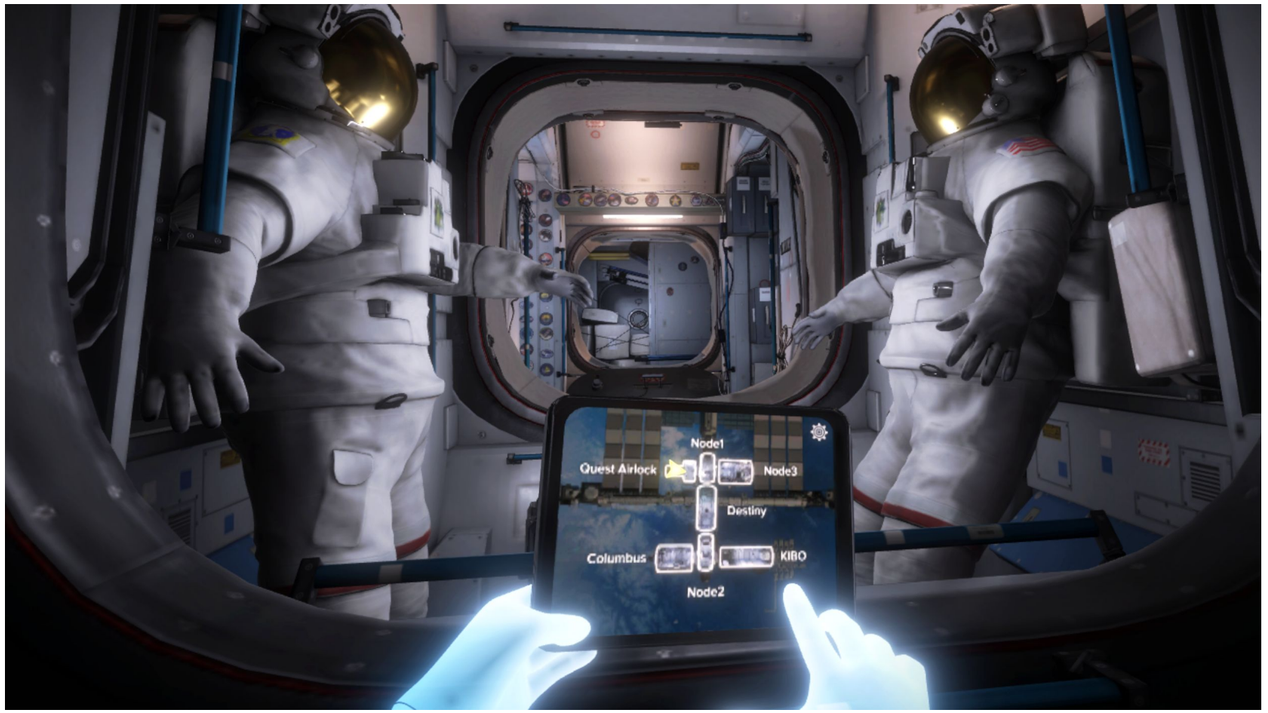
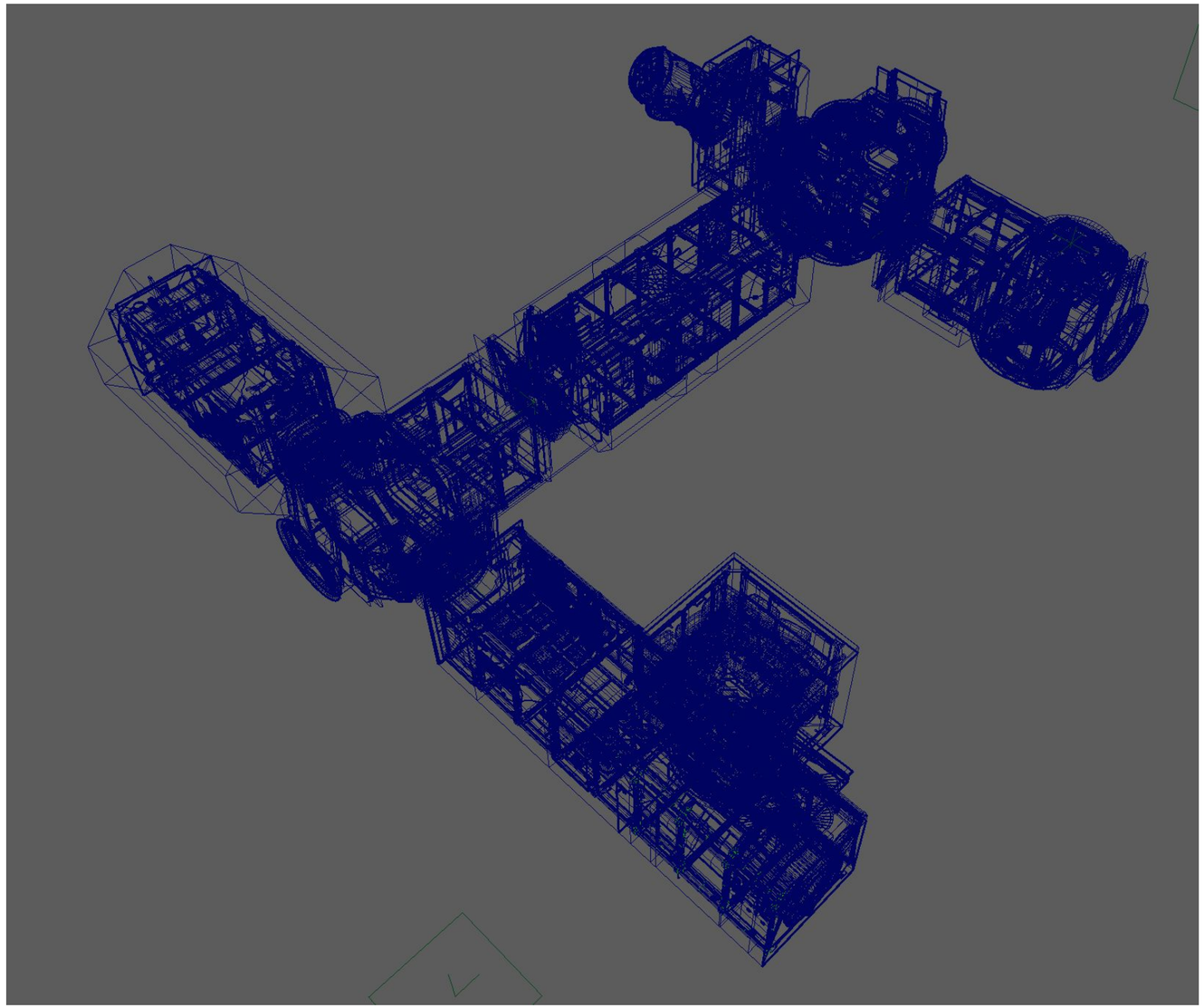


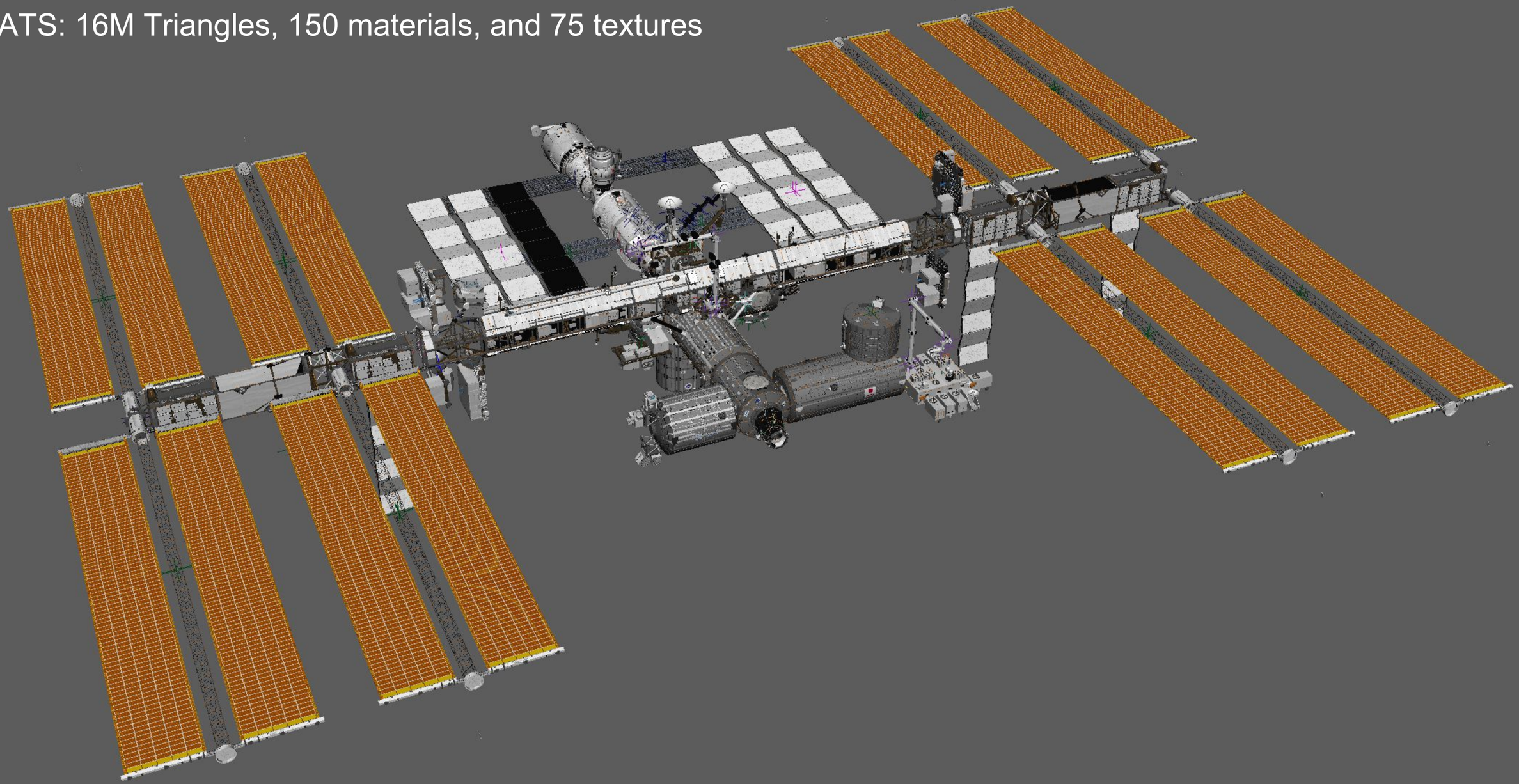

Node1
Quest Airlock
Node3
Destiny
Columbus
KIBO
Node2

ISS Interior

- Final stats:
  - 1.8M Triangles
  - 60 Materials
  - 150 Textures
- 6 months w/ 1 artist
  - 4 months main details
  - 2 months extra details + lighting

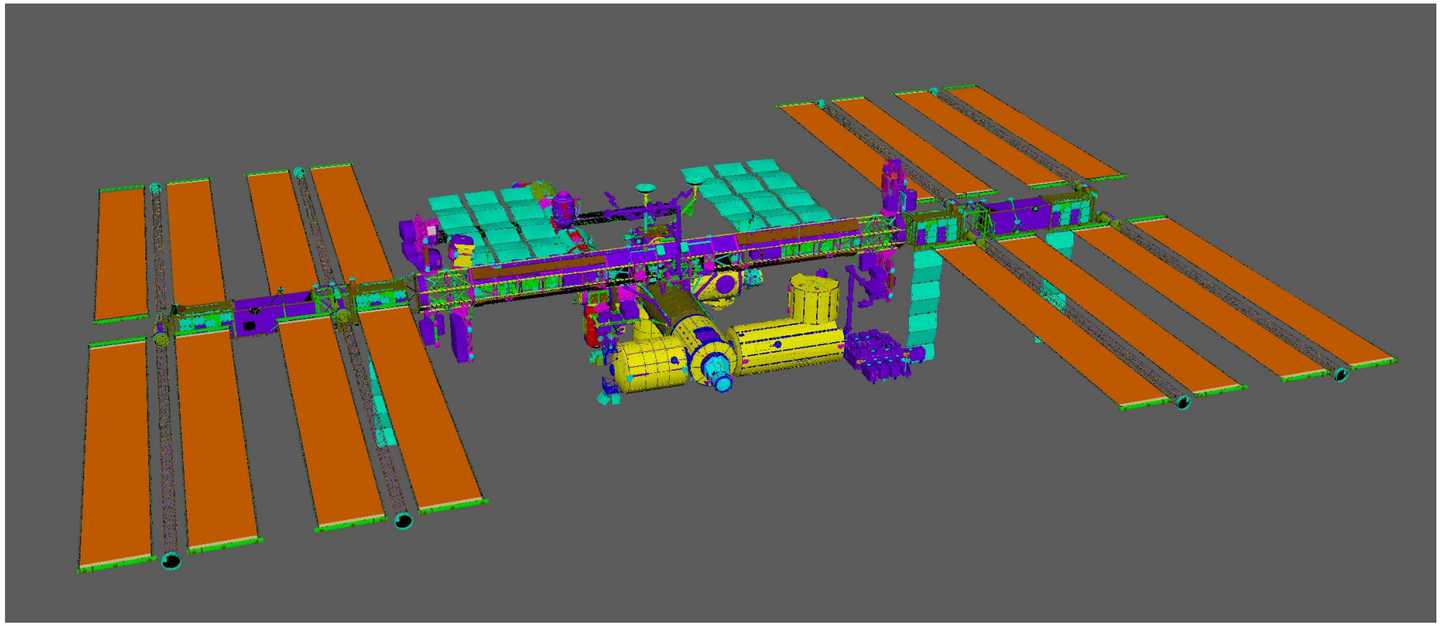


STATS: 16M Triangles, 150 materials, and 75 textures

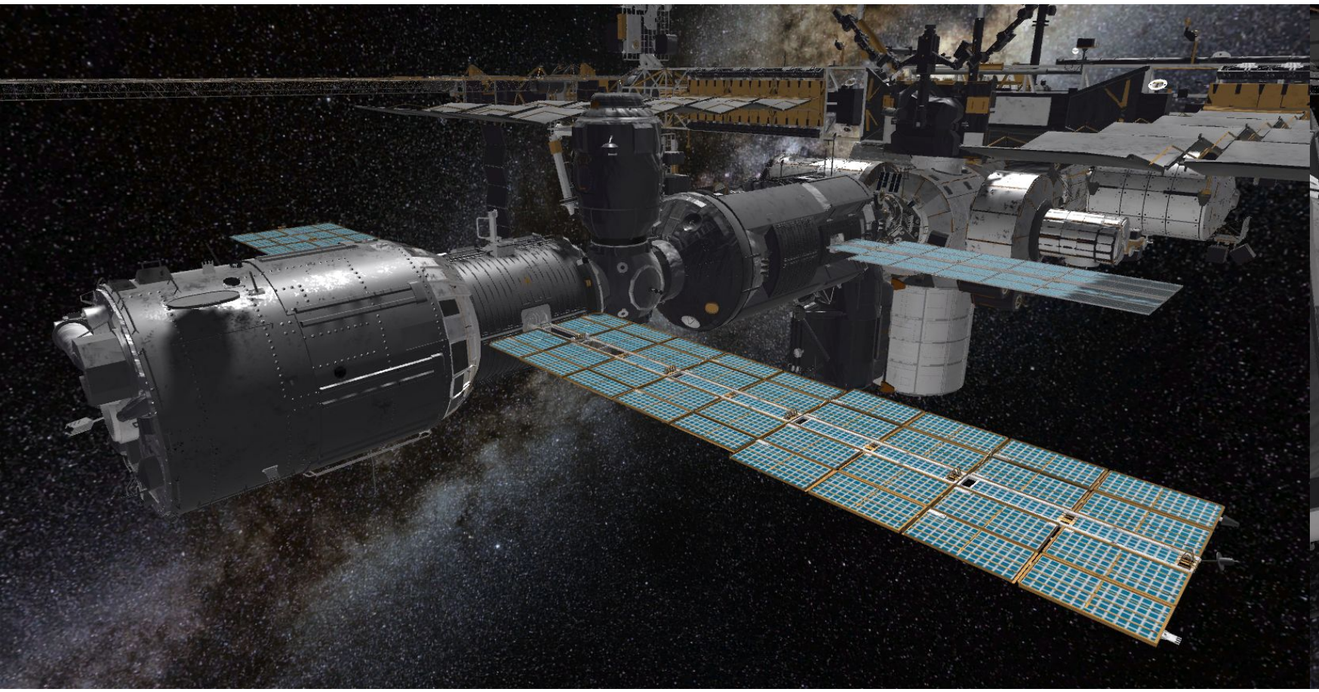


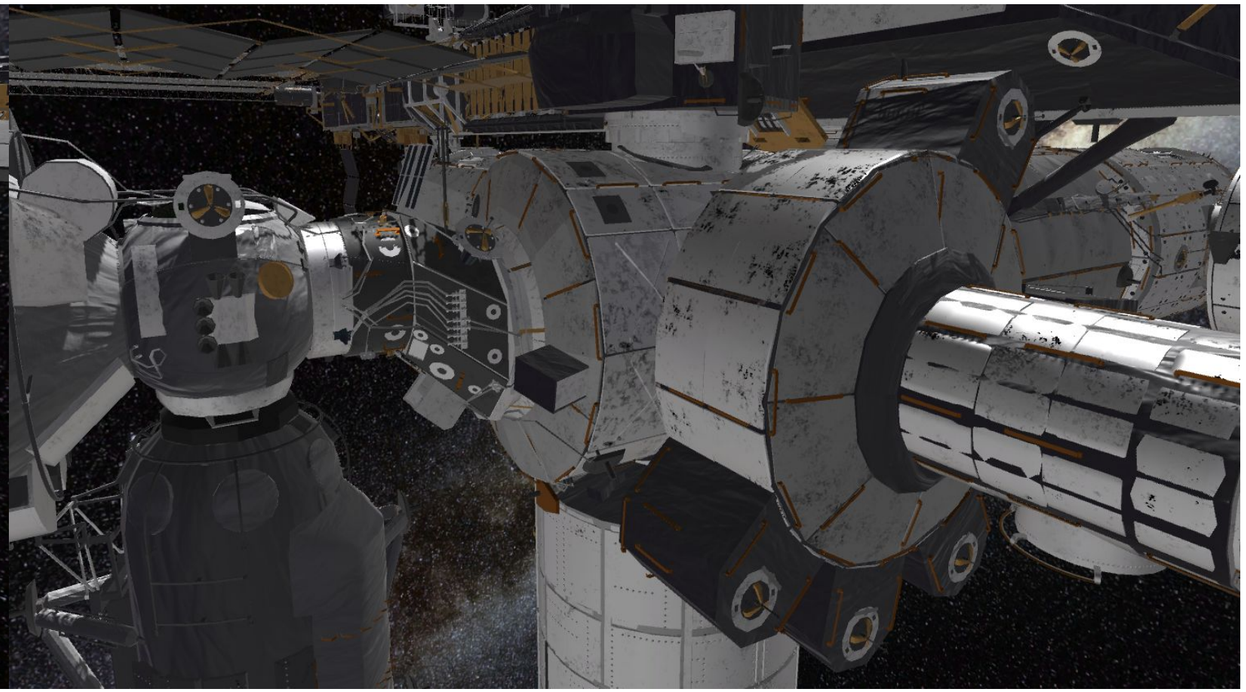
ISS Exterior

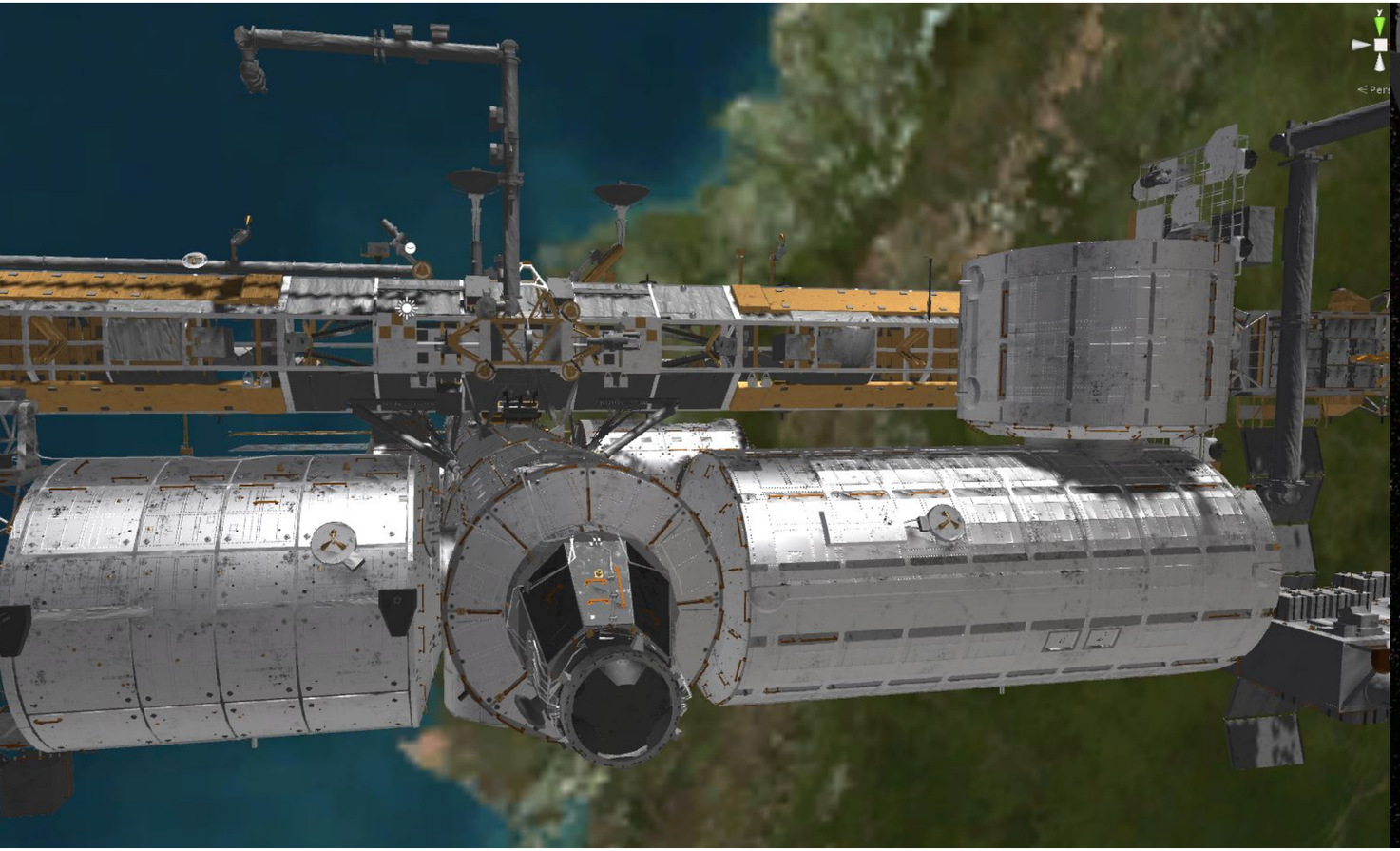
- First attempt
  - Exterior started later in production than the Interior.
  - Highly tileable/procedural approach

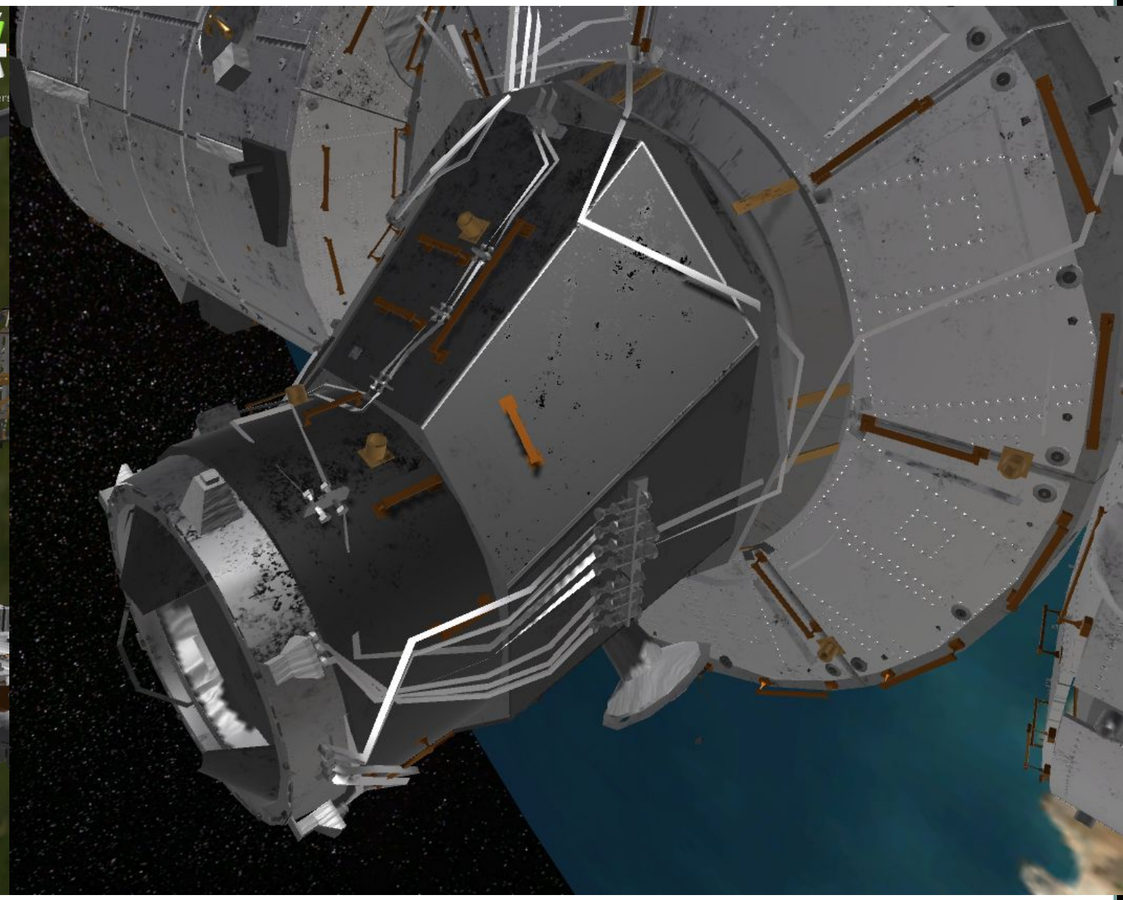


- Stats: 930K Triangles, 25 Materials, 14 Textures. Colors are shared materials.



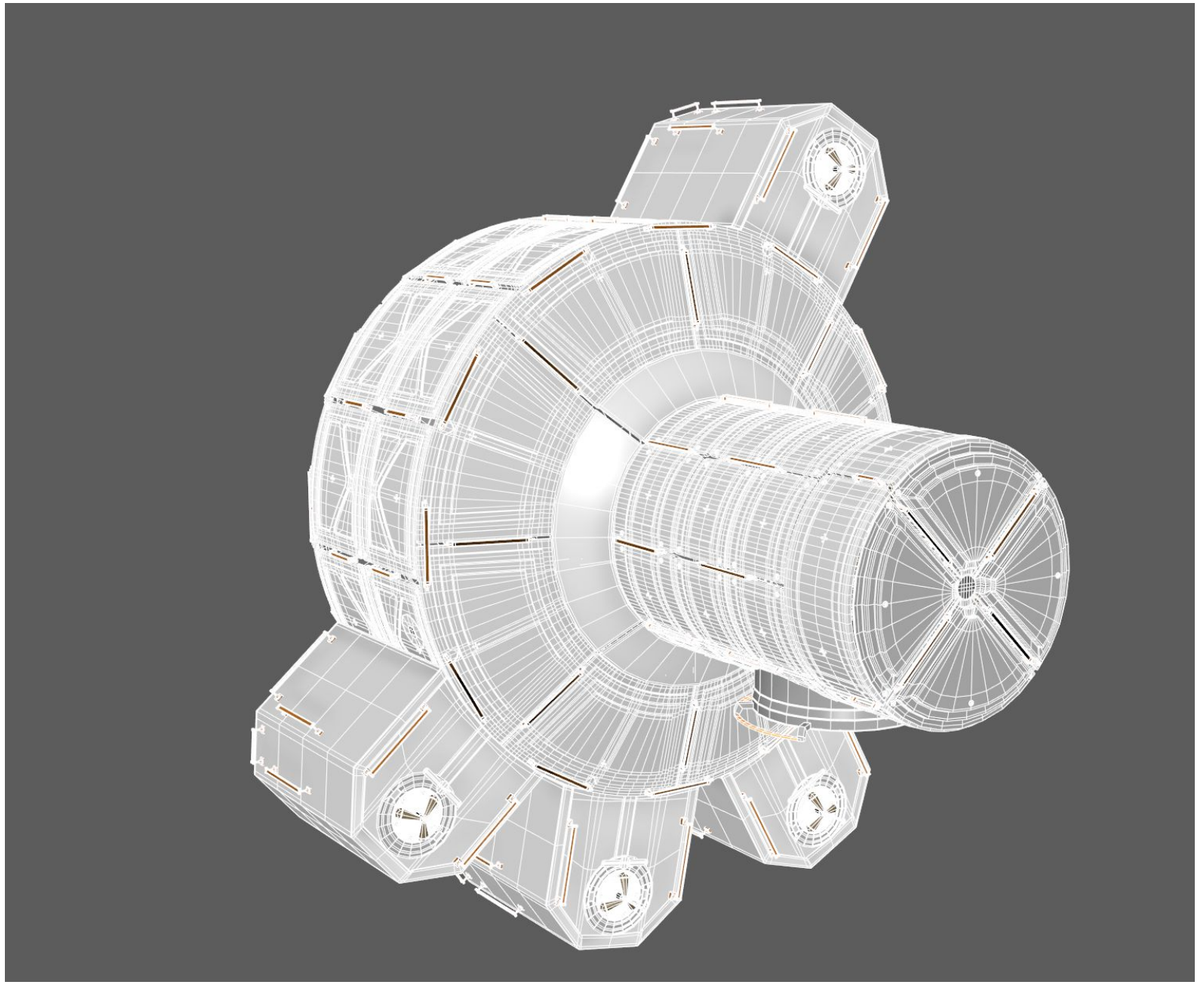






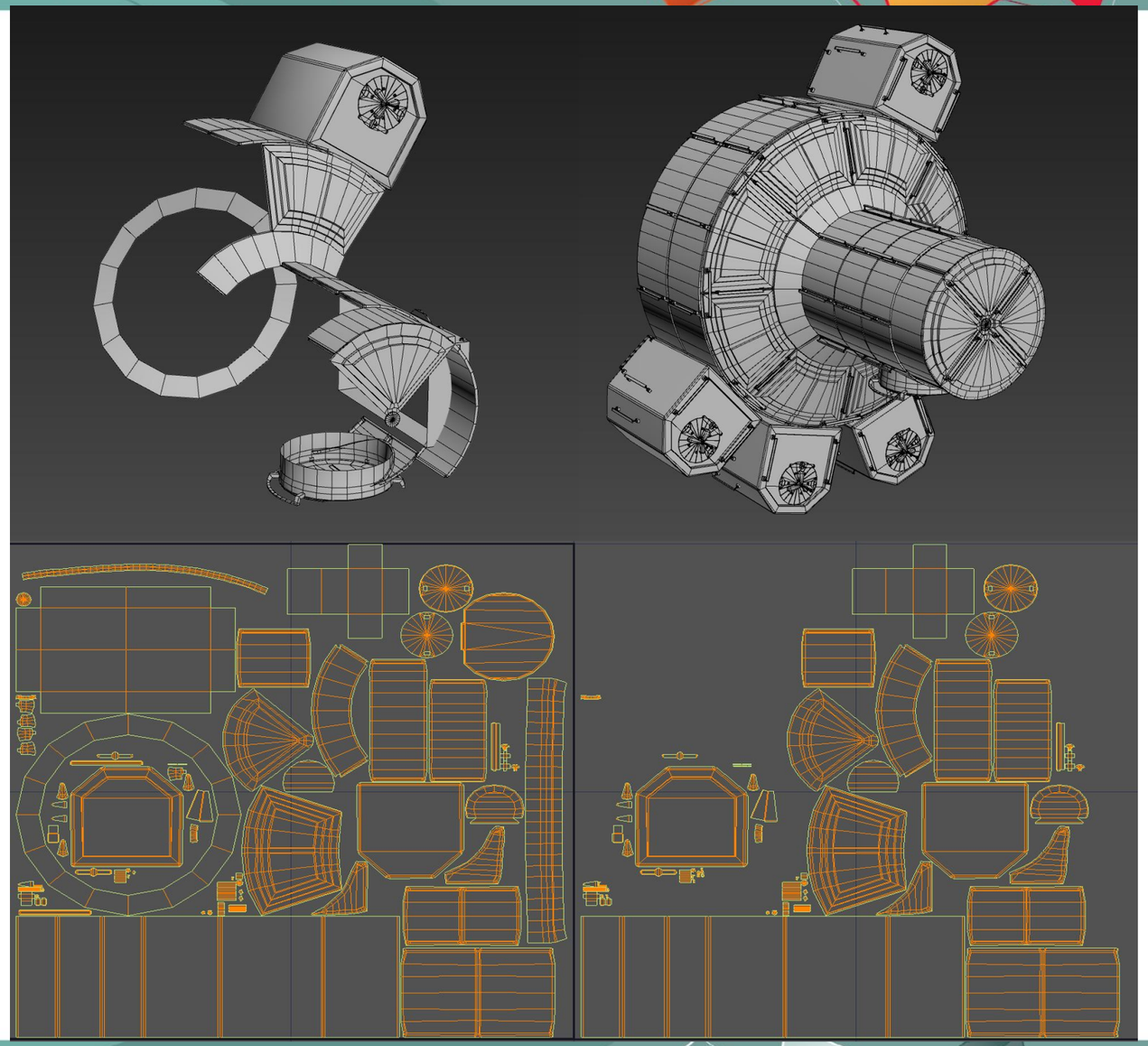
ISS Exterior

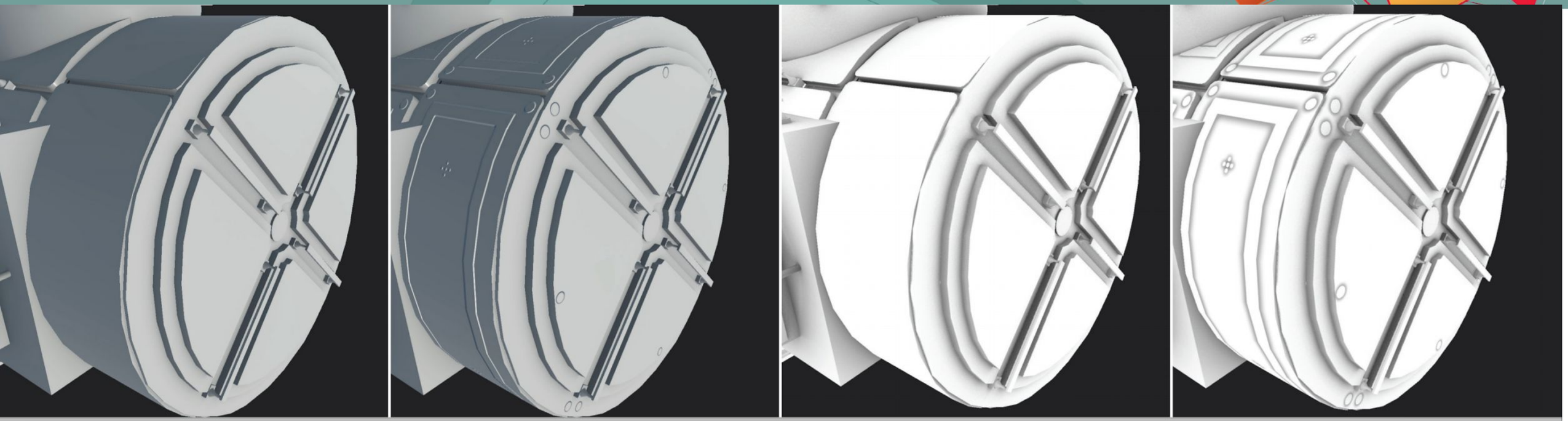
- Next Steps?
- Establish level of quality on a single asset
- Needed performance footprint
- Source mesh
  - 450K triangles
  - 15 materials
  - 5 textures

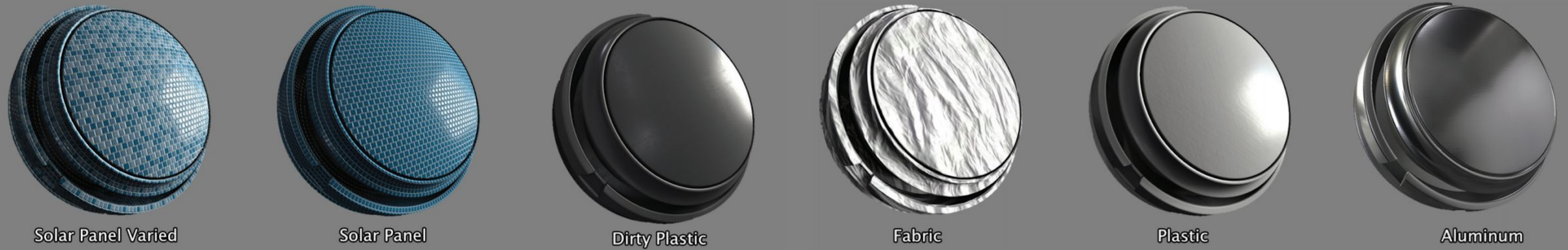


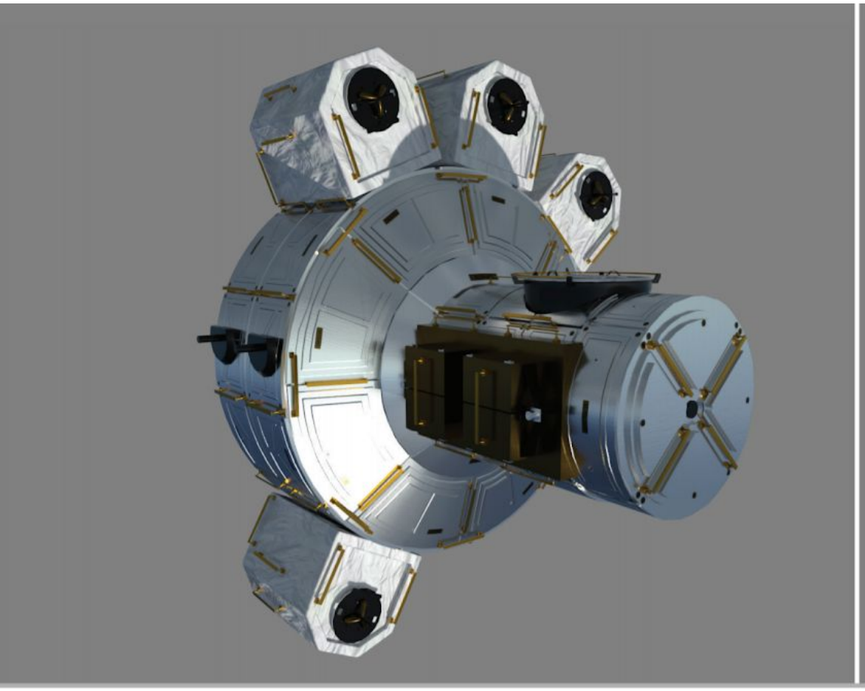
ISS EXTERIOR

- Isolate repeatable pieces
  - Cleanup
  - UV
  - Rebuild
  - Bakes
- Final count:
  - 28K Triangles assembled
  - 1 Material
  - 3 Textures.

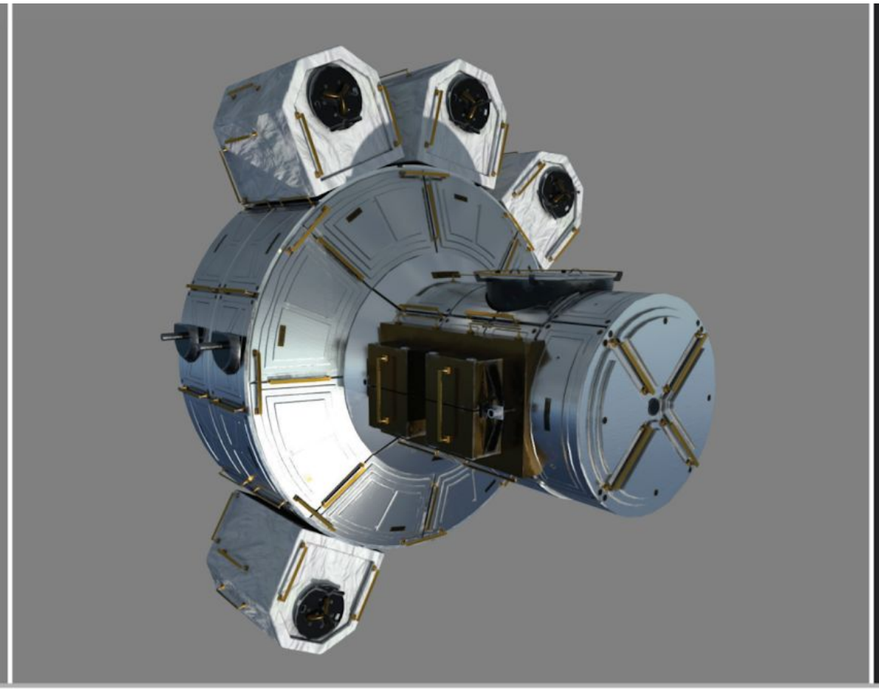




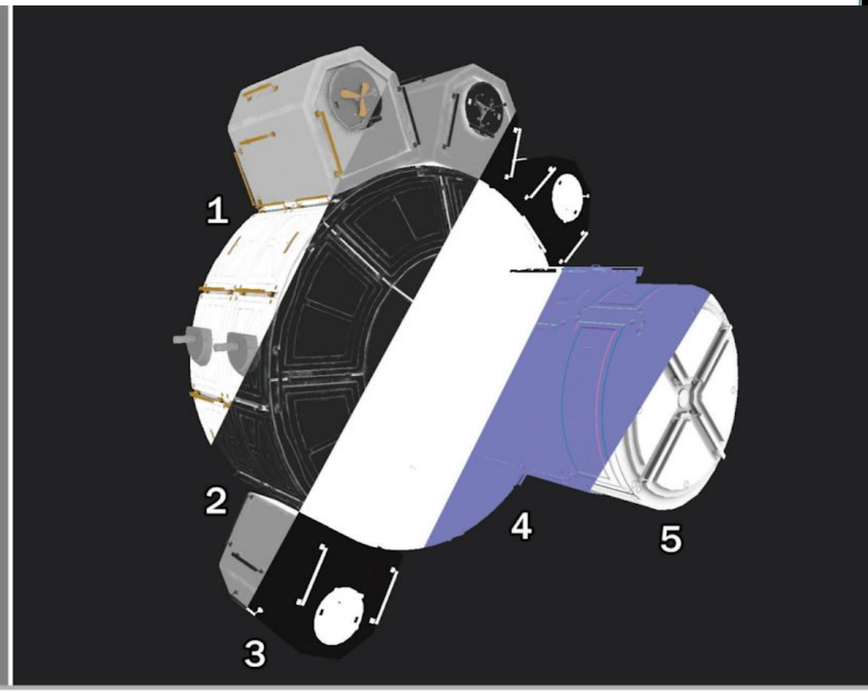

Solar Panel Varied
Solar Panel
Dirty Plastic
Fabric
Plastic
Aluminum



BASE MATERIAL PASS



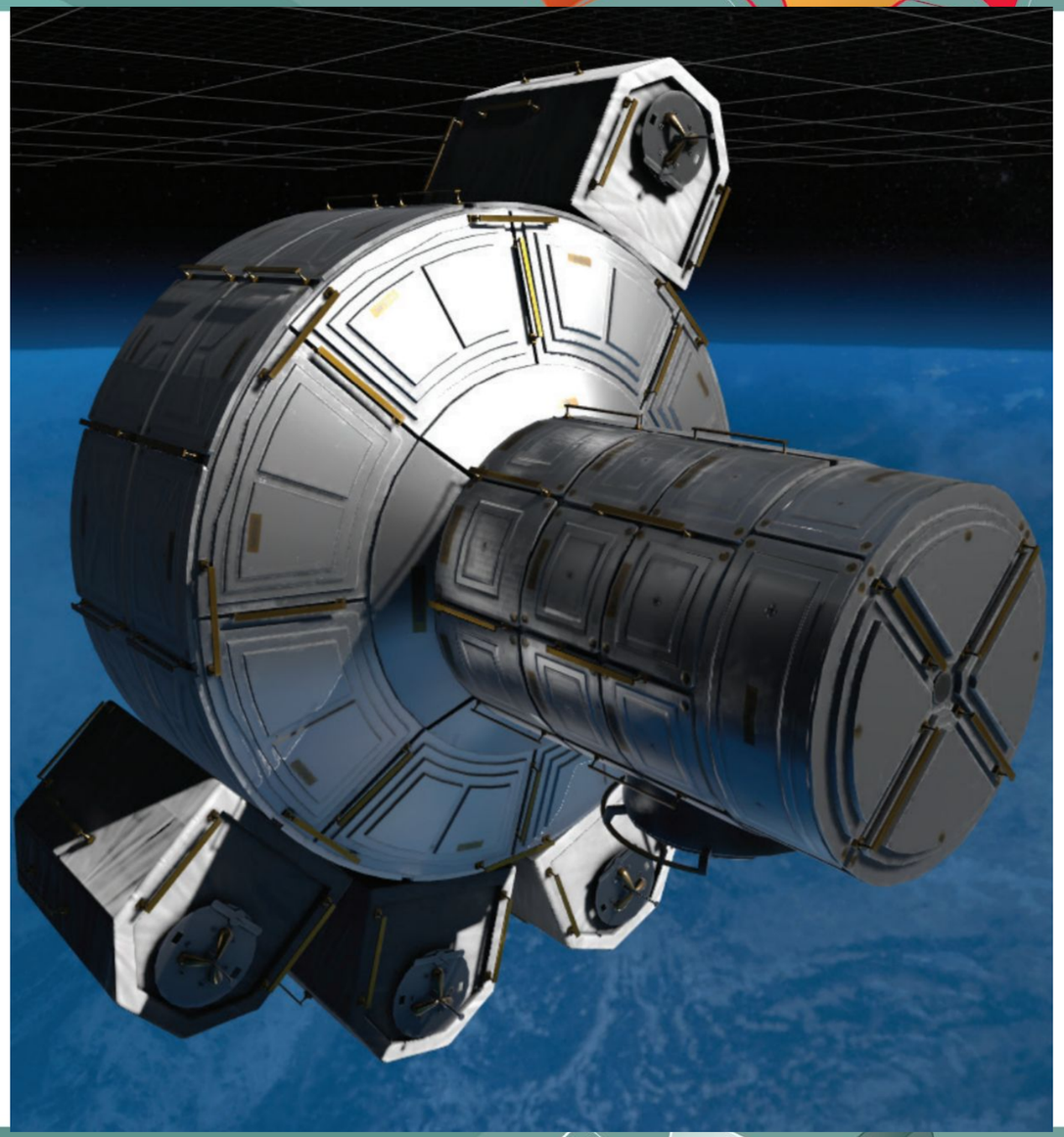
ISS_GRUNGE SMART MATERIAL APPLIED



DIFFERENT FINAL TEXTURES; 1 = COLOR, 2 = ROUGHNESS, 3 = METALLIC,
4 = NORMAL, 5 = AMBIENT OCCLUSION

ISS Exterior

- UNITY TIME!
  - Import Process
  - Greyscale Metalness



Texture Packing!

Unity Standard Shader

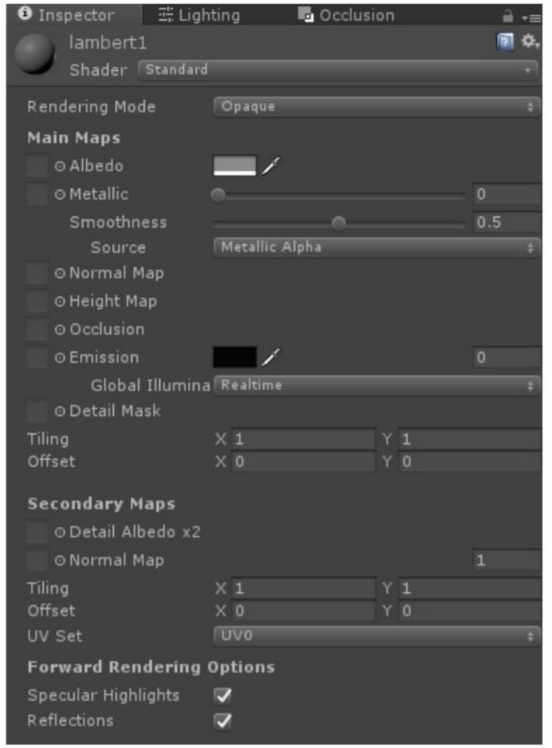
4k Base Color - RGB - 10.7MB
4k Metallic/Smoothness RGBA - 21.3MB
4k Normal Map - RGBnm - 21.3MB

4k Occlusion - RGB - 10.7MB
Total Texture Memory @ 4k: 64MB

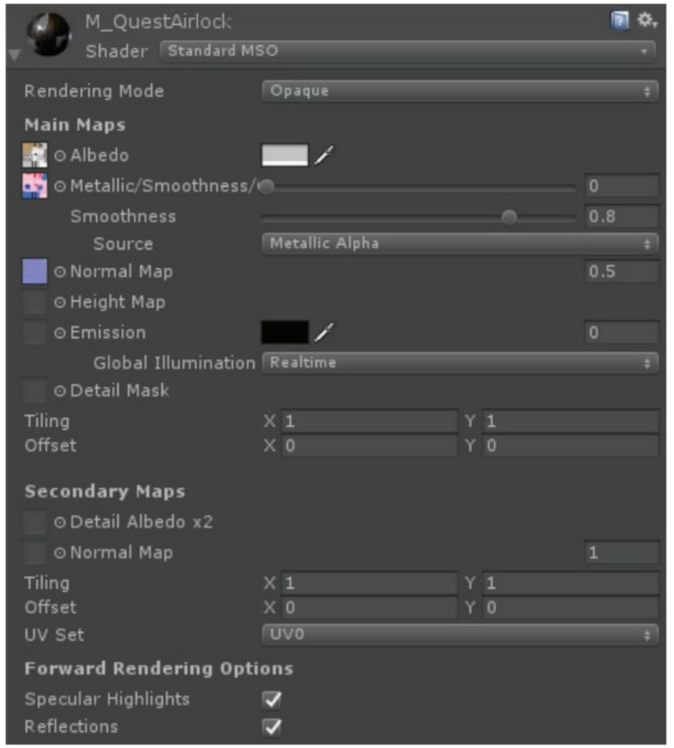
Modified MSO Shader

4k Base Color - RGB - 10.7MB
4k Metallic/Smoothness/Occlusion RGB - 10.7MB

4k Normal Map - RGBnm - 21.3MB
Total Texture Memory @ 4k: 42.7MB



DEFAULT STANDARD SHADER IN UNITY



FINAL SHADER PARAMETERS OF MSO MATERIAL

STATS: 1.7M Triangles, 30 Materials, and 90 Textures

Locomotion

Zero G Mechanics

- Very first implementation was already fun.
- Also felt natural.

Locomotion Goals

- "Realistic" feeling zero-G movement.
- Minimize simulation sickness.

Thrusting

- Alternative to hand movement.
- Great for exterior.
- Momentum based.

Hands don’t go through walls

- Originally wanted realistic hands with IK.
- Hands slide along surfaces.
- Needs very clean collision.
- Still needs failsafe.

Two-Handed Rotation

- Rotates world around you.
- Almost everyone likes it!
- Avoided one handed rotation.

Snap Rotation

- Need alternative to two handed Rotation.
- Snap 90°, 45°, 30°.
- Rotate around head.

Head Collision

- Added to the immersion.
- Tracking space issues.
- Solution unique to space.

Head Collision

- Sudden stops are jarring.
- Bouncing less.
- Sliding felt correct.
- Dampening velocity.

“Body” Collision

- Floor Problem.
- Movement Problem.
- Same Problem for hands.

Tech Summary/Conclusion

- Designed like a game.
- Accurate as possible.
- Comfort vs realism.

Conclusions

- 4-and-a-bit Star Store Rating
- Median play-time 30+ minutes
- Emmy Nomination
- GearVR version released about a year later

Astronaut testing

Garrett Reisman and his son visit Magnopus to test Mission ISS.

Q&A