CYBERMECH

Futuristic Combat Mecha Inspired by Tesla Cybertruck

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FINAL GAME PROJECT 2024/2025

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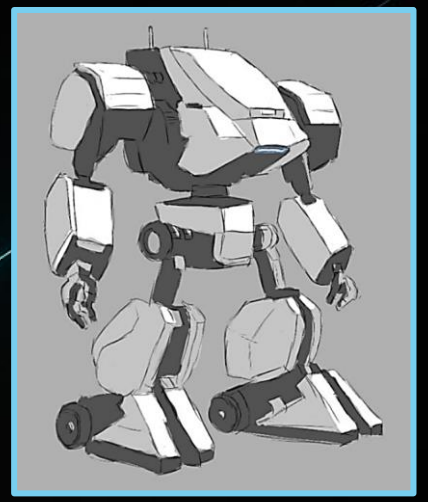
INTRODUCTION

The aim of this project was to create, build, and deliver a high-level 3D asset in a specialist area of interest, closely meeting industry standards for positions like concept artist, character artist, or game designer. This report demonstrates the complete production pipeline of a futuristic mech character, the CyberMech, created using inspiration from the angular, industrial design of the Tesla Cybertruck. The project takes previously developed skills in the modules to a new level of complexity by exploring more complex workflows in modelling, baking, texturing, and presentation.

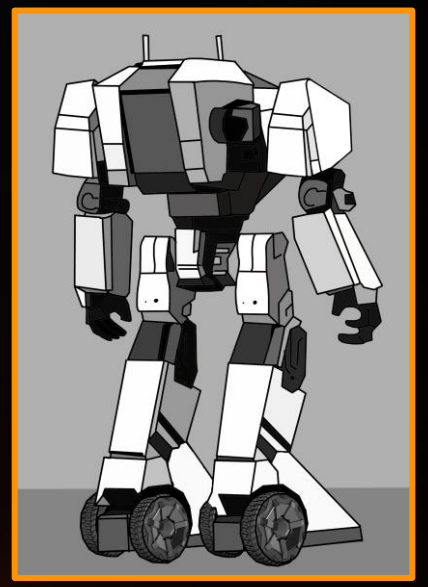
The aim was to create an artefact that not only demonstrates technical proficiency but also serves as an elegant portfolio piece for future employment opportunities. From final render and me optionally choosing to 3D print, the following process is a calculated process of research, development, and visual storytelling.

This report provides a full overview of the production process and concludes with a critical evaluation of the end product, both creative and technical decisions. Through this evaluation, I aim to detail areas for improvement and to describe how this project supports my development as an expert practitioner within the games industry.

PRODUCTION SUPPORT MATERIAL - CONCEPT AND INSPIRATION



The inspiration for CyberMech arose from the futuristic design language of the Tesla Cybertruck. Its sharp, aggressive contours and stripped-down, industrial styling gave it a mechanical aesthetic that easily applied to robot character design. I was particularly drawn to the combination of utilitarian engineering and sci-fi shape in the Cybertruck, and it was the ideal launching point to imagine a near-future mech built for combat or utility use. This design style was intended to have a realistic feel with a solid, futuristic appearance.



To begin the development of the concept, I drew sketches in Photoshop. The concept drawings were required for the silhouette, proportion, and mechanical articulation of the mech to be tested before proceeding into the 3D pipeline. The process allowed me to experiment with various structural components, such as: limb structure, body position and functional components such as the wheels and joints. I focused on presenting the design from different perspectives to get an overall impression of the form and to ensure consistency when 3DS Max modelling began.

These sketches not only established the foundation of the mech's design but also served as visual blueprints that guided the entire 3D production process.

Mood Board:

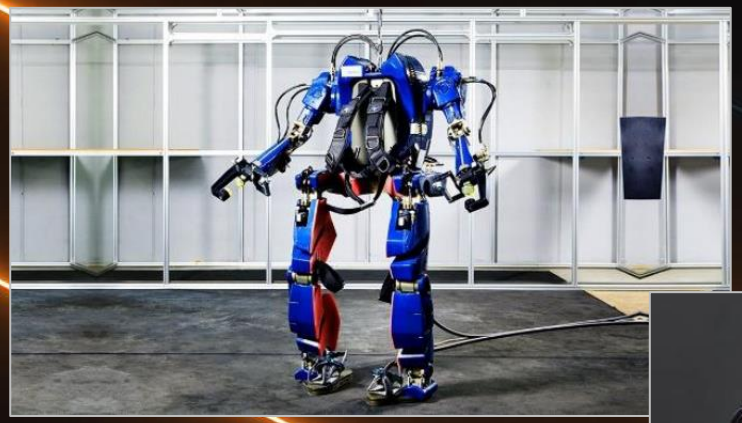


Figure 1

Figure 2

Figure 3

Figure 4

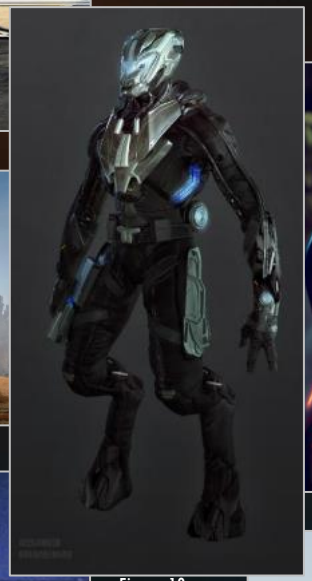


Figure 10

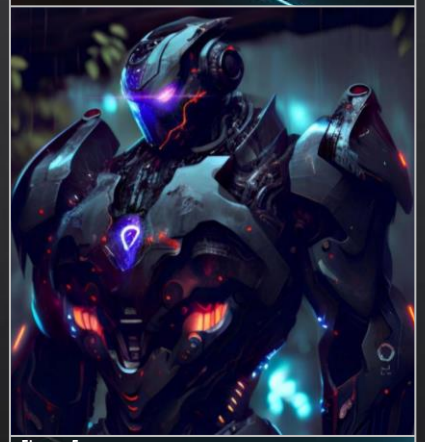


Figure 5

Figure 6

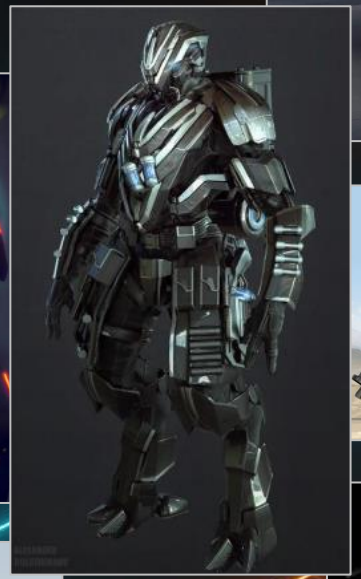


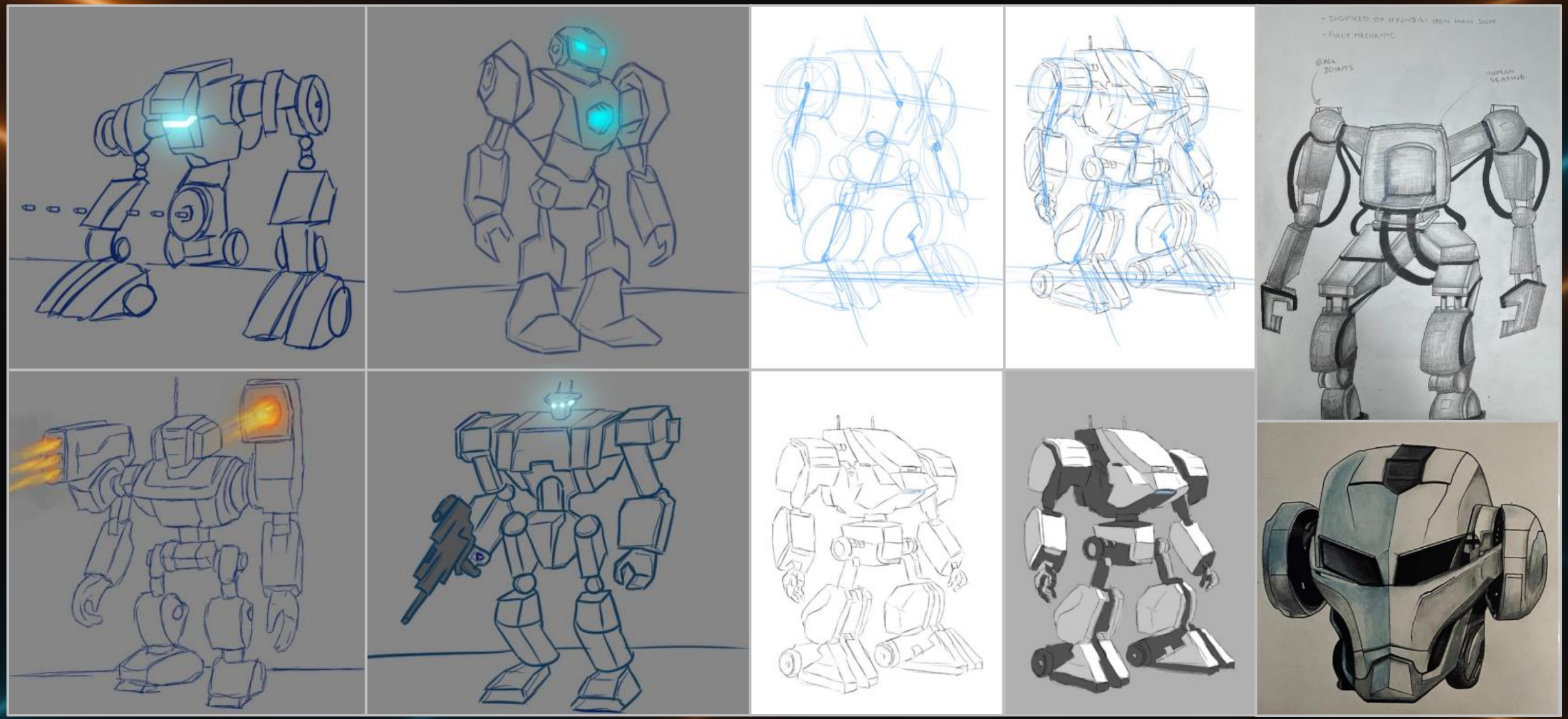
Figure 11

Figure 7

Figure 8

Figure 9

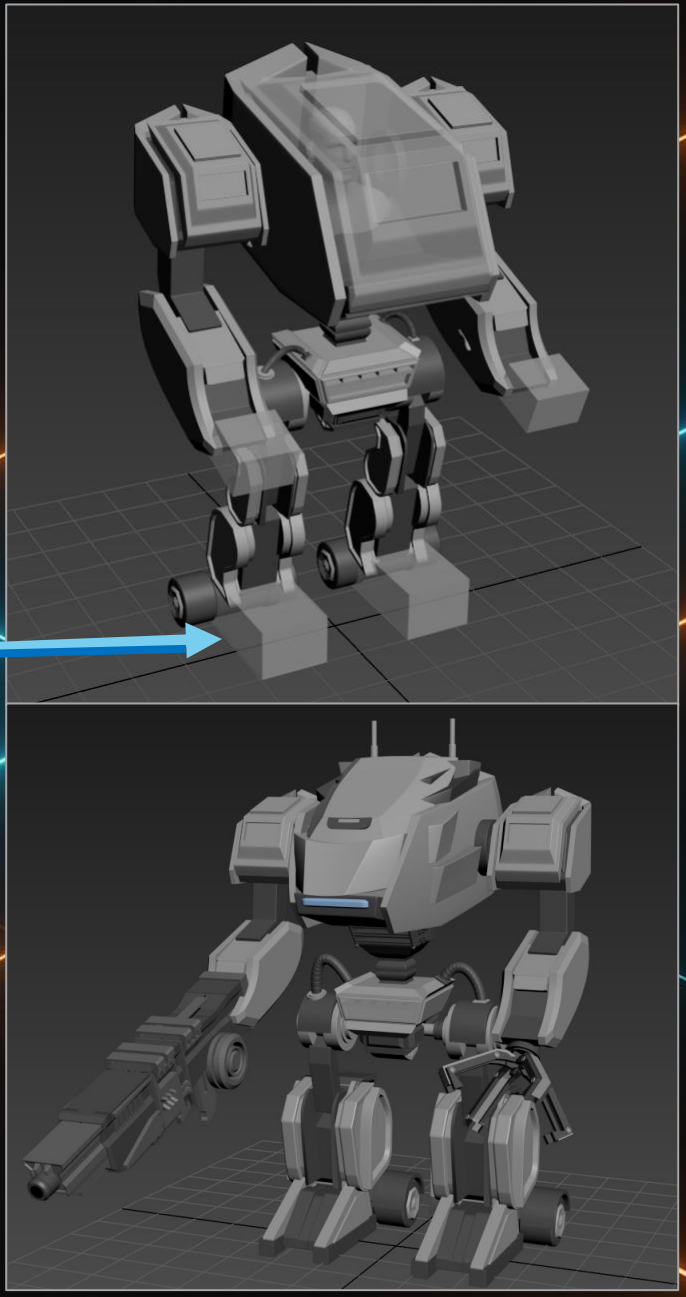
Digital and Traditional Concept Artwork:



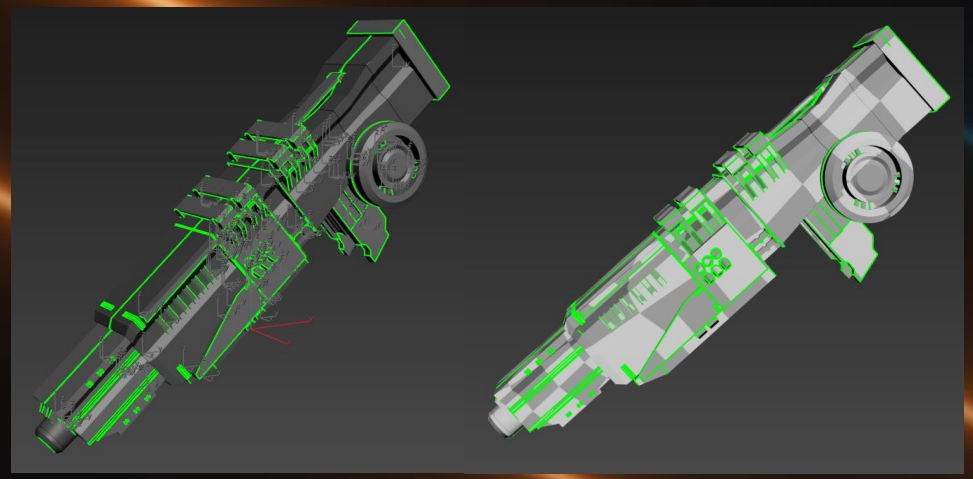
PRODUCTION SUPPORT MATERIAL - MODELLING PROCESS – 3DS MAX

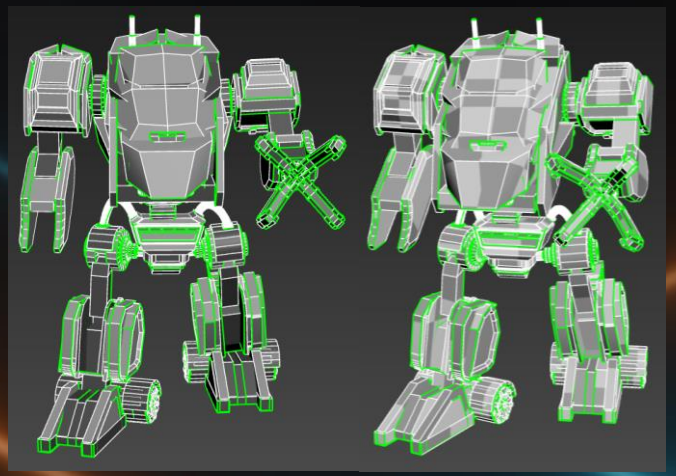
The modelling process began in 3DS Max, where I constructed all three of the main assets: the mech, its gun and the base. They were all created as hard surface models founded on accuracy, clean topology, and efficient poly distribution. The process began with blocking out the base shapes using simple primitives like boxes and cylinders to establish silhouette and scale prior to adding complexity.

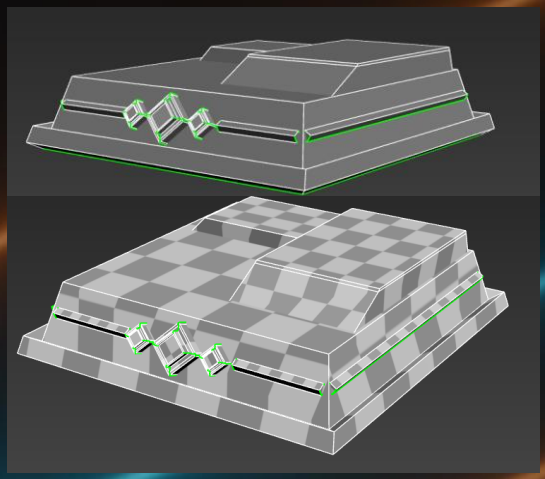
For the main mecha character, clean edge flow and logical edge looping were maintained throughout the mesh so that every element would bake properly. Arms and legs were subdivided with care in areas needing definition while maintained optimised for flat, hard-surfaced surfaces.

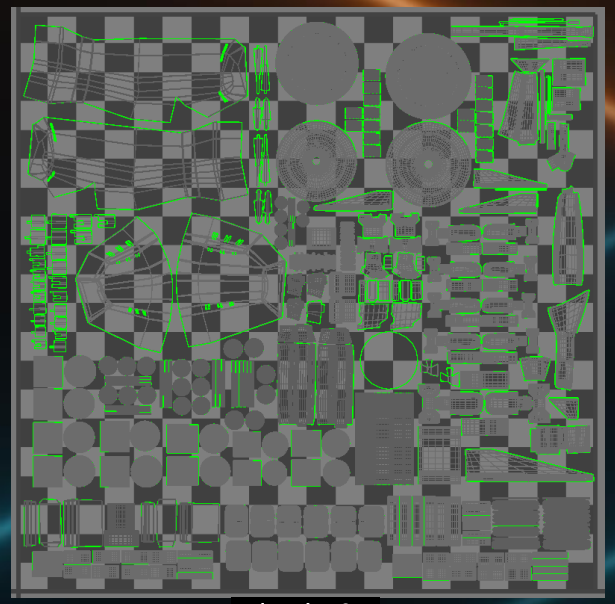


UV layout images:

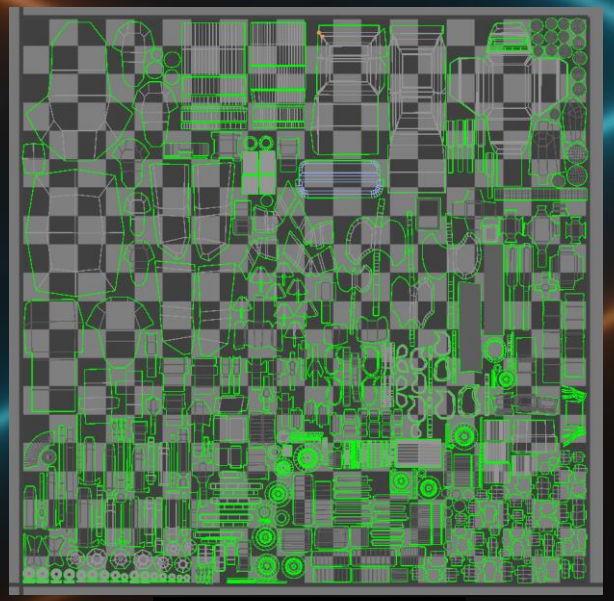




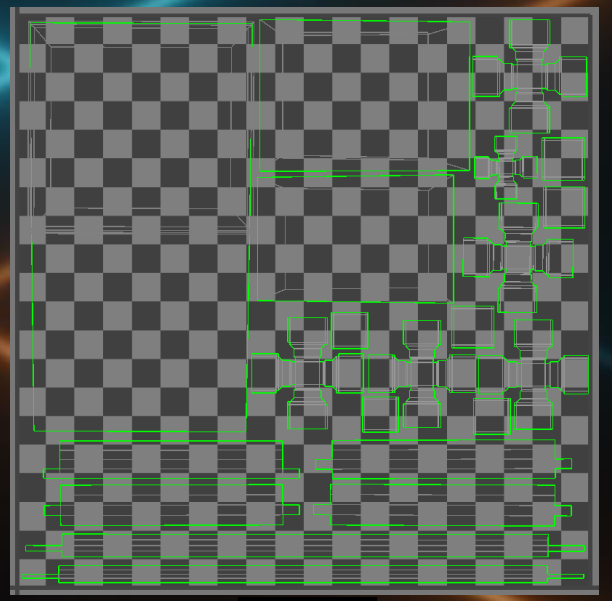




Mid_Poly_Gun

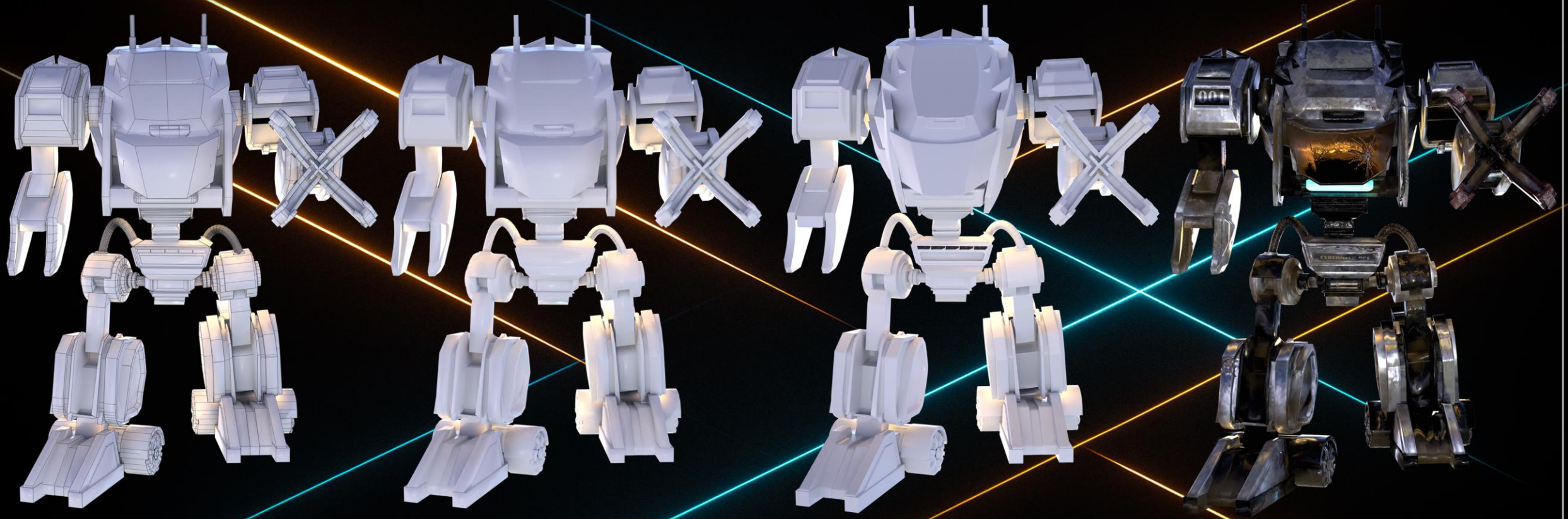


Low_Poly_Mecha_Without_Gun



Low-Poly_Gun

Mecha Breakdown



Wire Frame

Low-Poly

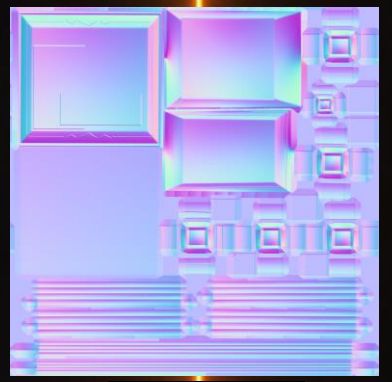
High-Poly

Textures

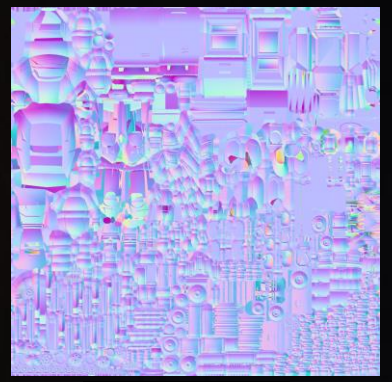
For the gun, a mid-poly modelling approach was utilized. This allowed me to maintain vital detail like vents, chamfers, and panel lines without jamming the mesh. The form of the gun required meticulous cylindrical and inset detailing that included nice shading control, especially on the barrel and energy cell sections. Symmetry and good smoothing groups needed to be maintained to ensure shape during the bake and texture phase.

The base platform was the least structurally complex in terms of mesh but was still modelled with clean geometry to hold on decorative shapes such as trim panels and emission grooves. All details were extruded or bevelled with chamfer modifiers and manual support loops to achieve clarity in the high-poly sculpt. After I had modelled high-poly versions of all the assets, I created their low-poly versions by minimizing geometry without sacrificing silhouette and bake-dependent detail. In order to maintain full control and ensure proper UV mapping, this was done manually within 3DS Max. High-poly models were then used to bake normal maps in Marmoset Toolbag.

PRODUCTION SUPPORT MATERIAL - BAKING – MARMOSET TOOLBAG



Bake_Base_Normal



Bake_Mecha_Normal

After completing the high and low poly versions of the CyberMech model, I baked the normal maps in Marmoset Toolbag 4. This was necessary to transfer the surface detail from the high poly sculpt to the game-ready low poly mesh so that I could preserve the model's sharp edges and detailed features when optimizing it for performance.

I began by positioning the high and low poly meshes carefully and preparing the baking in Toolbag. I used the default cage system but encountered artefacting and soft edge issues particularly on steep crevices and overhang geometry, such as the arms and head section. The artefacts took the form of shading faults and edge distortion in the early test bakes. To solve this, I expanded the maximum cage extrusion so that the projected rays during the bake fully surrounded the high poly geometry, eliminating missing projections and clipping issues. The two normal maps included are proof of the process. The sharp, smooth edge transitions and detailed bevel detail transferred well onto the low poly surface to give the mech a visually detailed appearance without additional geometry. The border along the panel edges and diamond points on the base are especially evident, demonstrating how well the high-to-low poly transfer was executed. This process also helped in discovering which segments of the low poly mesh were under-optimized-where the faceting was still apparent even after baked smoothing informing potential adjustments for future models. Baking in Marmoset gave me more control than automatic processes, and I learned more about cage management, ray direction, and how mesh naming conventions and baking group naming conventions would enable me to isolate different sections of the model when projecting.

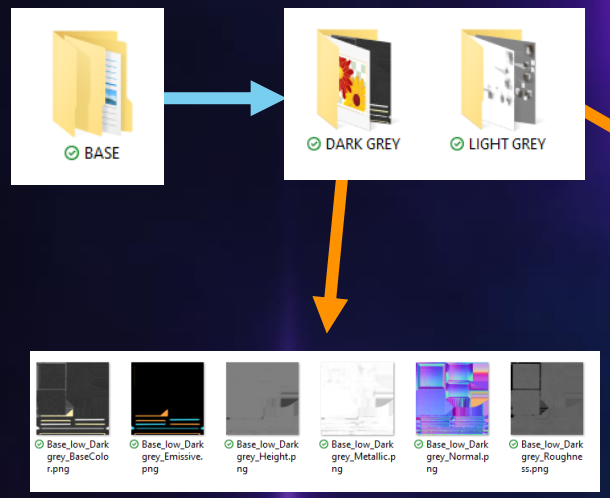
Overall, this stage significantly enhanced the visual realism of my game asset and allowed me to continue texturing in confidence, aware that I had retained the sculpted detail in a performance-effective format.

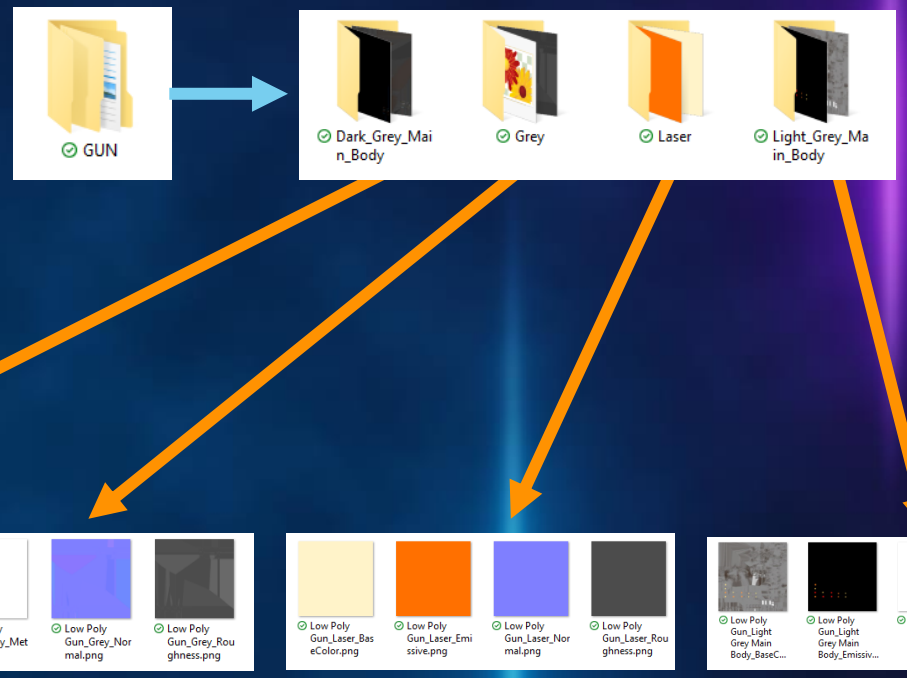
PRODUCTION SUPPORT MATERIAL - TEXTURING – SUBSTANCE PAINTER

Once UV-unwrapped under UV from the low-poly model and baked in Marmoset Toolbag, the task was moved to Substance Painter for texturing. The most important thing for this task was to continue developing the futuristic industrial appearance while giving the asset surface realism through material definition, edge wear, and storytelling details. The first stage of texturing involved the application and organization of smart materials in line with the types of surface created in the modelling stage. These were then refined using bespoke masks and fill layers to produce a stratified, realistic surface. The mech's materials were split into two prevalent hues: a dark grey steel and a light alloy silver, offering visual contrast and accentuating its panelled, angular aesthetic.

To suggest that this mech had seen some action, I applied layers of dirt, grime and edge wear, especially around joint cavities, the surfaces of weapons and high-impact points. On metallic components like the legs, gun barrel and head area, I applied a subtle roughness variation to break up too-clean reflections and impart a worn and terrestrial texture. The roughness and metallic maps were most important to sell the material authenticity. Smoother gloss levels on lit or frequently touched areas helped guide viewer attention, while duller areas reduced visual noise. The height maps added additional surface detail breakup on indented panel lines and bolts without adding geometry, subtly implying form. In the process, I also made use of distinctive alpha information such as decals to provide the mech with purpose and origin. These were an ID stamp, and the addition of a lighted visor section gave the asset identity and a position within a larger sci-fi universe.

The final texture set included Base Colour, Metallic, Roughness, Normal, Height, and Emissive maps. These were all exported at 4K resolution so that they were crisp enough to enable high-resolution rendering and promotional presentation. The result was a layered, worn but high-tech surface finish that could enable both visual storytelling and game-readiness. These were organised into folders for easy-finding and efficiency.

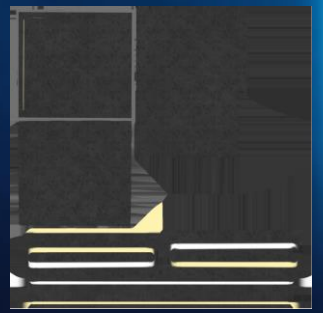




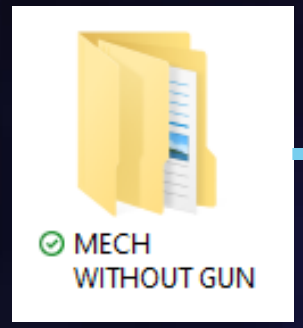
(Texture maps split up into colour groups, for example, dark areas and light areas have their own UV island).

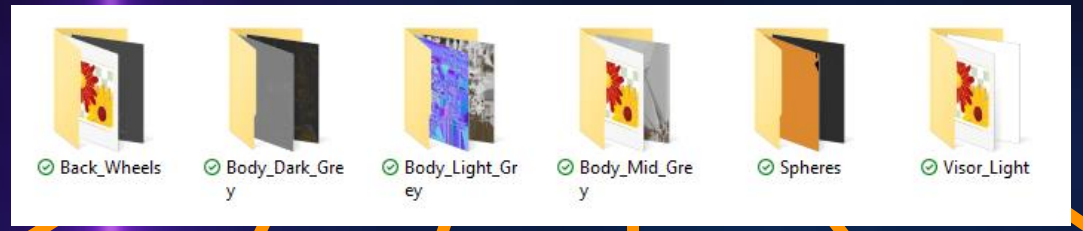
Main Albedo Maps:

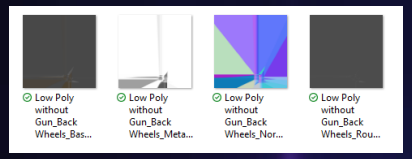

Mecha_Body_Light_Grey

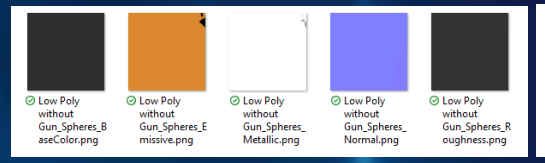

Base_Dark_Grey

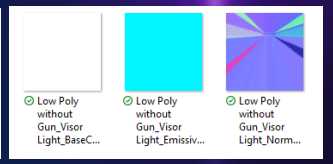

Gun_Light_Grey

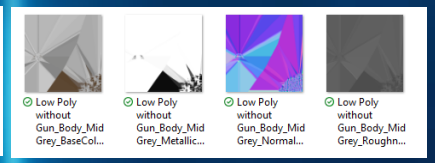




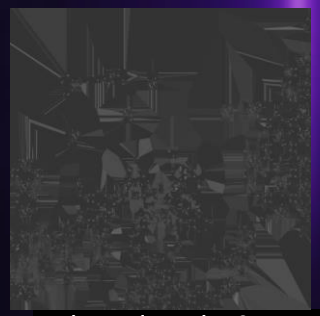








Main Roughness Maps:



Mecha_Body_Light_Grey

Base_Dark_Grey

Gun_Light_Grey

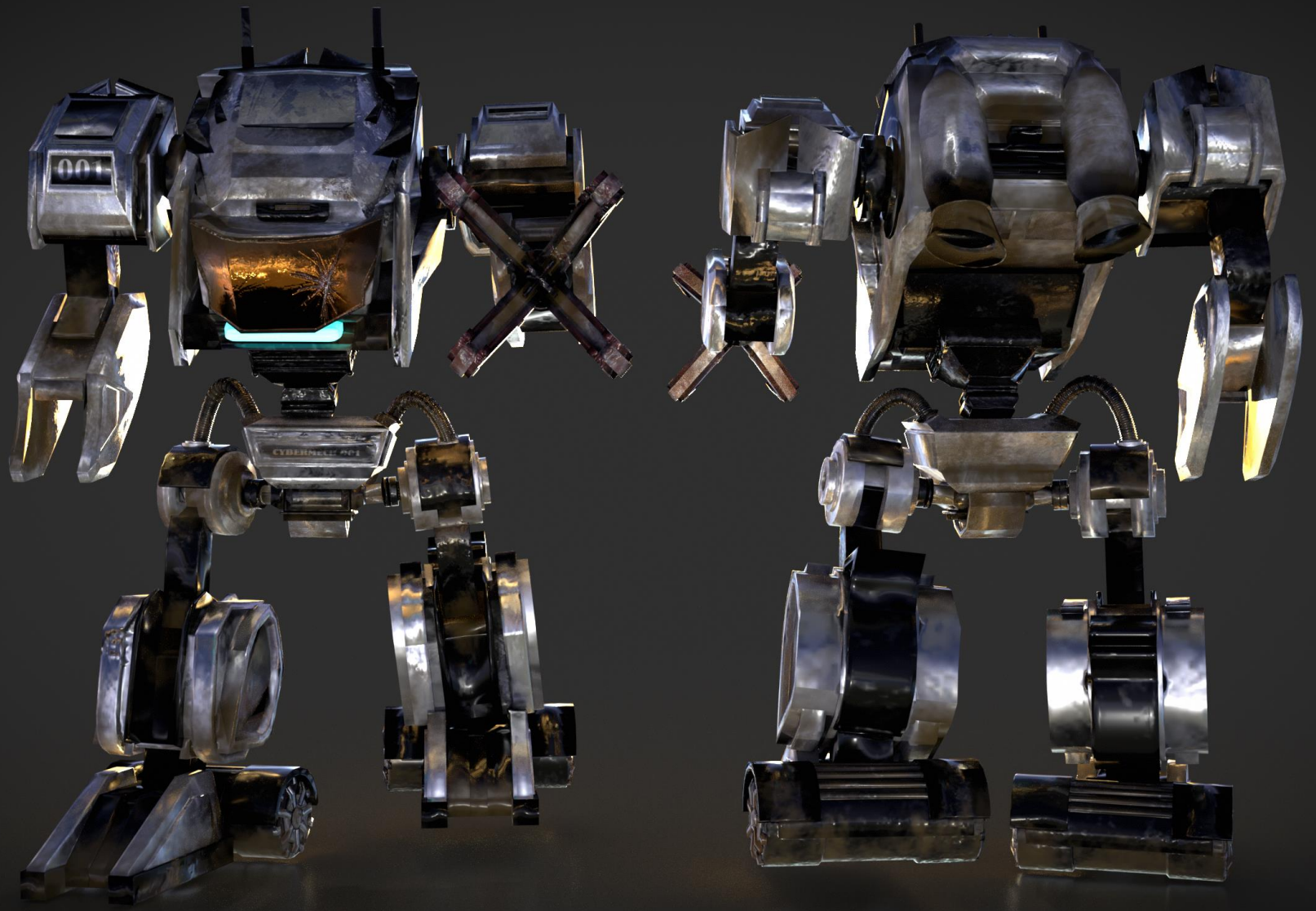
Main Metallic Maps:

Mecha_Body_Light_Grey

Mecha_Body_Dark_Grey

Base_Light_Grey

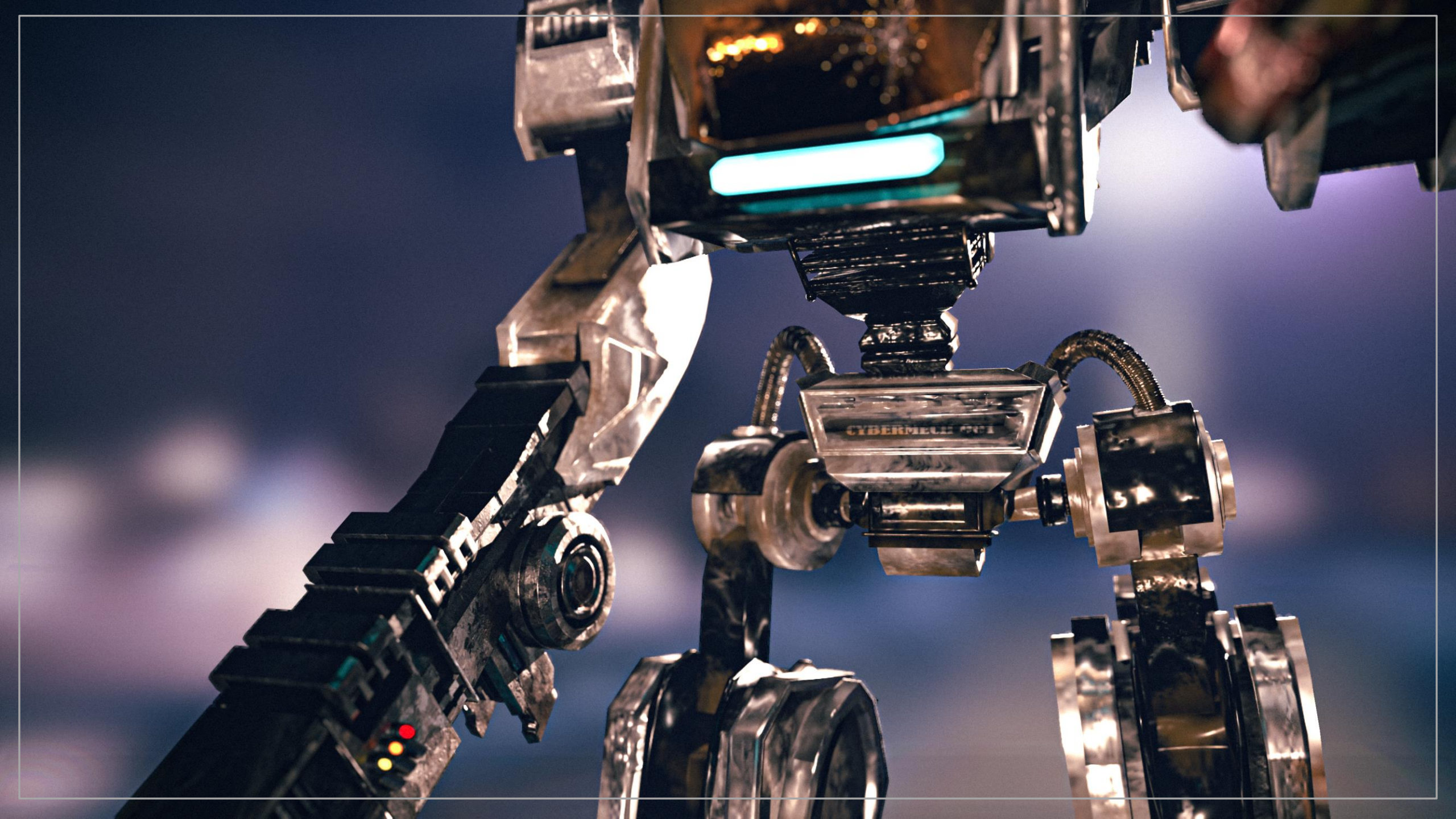
SUBSTANCE PAINTER RESULT



FINAL RENDERS

My last few renders for my CyberMech model were created in Marmoset Toolbag 4, utilizing ray tracing and emissive light abilities to infuse more realism and cinematics into the presentation. Leverage of Toolbag's real-time ray-traced reflections and global illumination allowed for highly accurate lighting response, giving a realistic feel to the metal armour of the mech with believable weight, reflectivity and depth of materials. The emissive elements (the vivid cyan visor and glowing panel lights) stood out particularly vibrantly against the darker colours, adding contrast and vitality that enhanced the effect of the scene. They helped bridge the gap between game asset and cinematic render quality.

Beauty shots with multiple camera angles were taken to highlight areas of detail. Wide-angle and close-up framing was used to expose both the silhouette and details of the model, such as the arm cannon, mechanical joints and claw hand. Depth of field and focus settings were controlled in-camera to highlight key features, giving the final images a photographic quality. Lighting was positioned to create dynamic highlights and soft shadows, highlighting surface qualities and emphasizing the form of the mech. Overall, the renders present the CyberMech as a polished and production-ready asset.



PRODUCTION SUPPORT MATERIAL – 3D PRINTING PROCESS

UltiMaker Cura

Figure 12: Software used to 3D print - *UltiMaker Cura*

In order to supplement my virtual production workflow, I chose to 3D print the CyberMech model to create a physical object to present in portfolios and have on hand during interviews. This exercise not only confirmed the physical viability of my digital product but also gave me a chance to get a firsthand experience of the technical process involved in preparing a high-poly model for additive manufacturing.

I exported the model from 3DS Max and ZBrush (filling the gaps in my model to be water-tight) as a high-detail STL model, which I imported into Ultimaker Cura for slicing preparation. This stage involved aligning the model for optimal print quality, scaling correctly for a small but detailed physical output, and configuring optimal print settings for resin. I made sure that I properly hollowed and supported the model to maintain integrity while printing and to avoid excessive use of resin.

The printing itself was performed using resin-based SLA printing, which achieved very good surface fidelity and crisp detail retention. The first picture in this section is of the mech after print, with support structures still intact. These supports were essential for overhanging areas, particularly the arms, legs and the gun - carefully crafted in the slicing process. I hand-cut these supports off using flush cutters and did some gentle sanding to avoid surface feature damage.

PRODUCTION SUPPORT MATERIAL – 3D PRINTING PROCESS

The images below show the cleaned and complete 3D printed model from several different perspectives. Seeing the CyberMech in physical form re-affirmed the solidity of the design from all angles and helped ensure that the proportions and mechanical properties of the model were accurate. Making a physical artefact added a rich dimension to the project as well, providing a tactile and visually striking way to demonstrate my modelling skill to potential employers and peers.




EVALUATION AND REFLECTION EVIDENCE – PROJECT CONCEPT

The goal of this project was to design and build a fully realized 3D mech character that could serve as a professional-grade asset for both physical model prototyping and real-time rendering. My goal from the start was to design something that was functionally realistic but futuristic, something that could plausibly exist in a sci-fi environment. The initial inspiration was the Tesla Cybertruck, and just its angular, modular surface language, which was so perfectly tailored to a robot body. I wanted to know how this car visual language would translate into character design in the context of a game or film.

One of the strongest aspects of the concept was its obvious design identity. The sharp edges, crisp geometric shape, and functional details such as the gun arm and claw hand served to give the mech both a believable and stylised appearance. These added up to make a clear shape for the character and a practical, engineered look, which seemed appropriate to inhabiting genres such as sci-fi shooters or strategy games.

That said, there were also divergences from the original idea. My mech was initially designed to be human-piloted early on during the block out stage in 3DS Max, but I changed it to a fully autonomous robot during design refinement. This allowed for more freedom in terms of designing the head and upper torso and eliminated the need for a visible cockpit, making for a final model that is more streamlined and coherent in silhouette.

If I were to revisit this project, there are a couple of things I would do differently. First, I would attempt to animate the robot to demonstrate its mechanical range of motion, which would be extremely useful in a game or cinematic context. Second, I would hand-paint the 3D print using either acrylics or airbrushing methods to enhance surface legibility and realism in physical appearance. Lastly, while I was happy with my low poly model for baking and rendering, now I realize that it was too low poly in certain areas, like the arms and gun, where faceting is apparent and affects the silhouette. Slightly higher polygon count in vital areas would have helped the real-time appearance as well as the 3D print outcome without damaging performance.

EVALUATION AND REFLECTION EVIDENCE – RESEARCH AND DEVELOPMENT

The development of this project was greatly research-driven. I drew inspiration from a broad range of sci-fi sources, such as the Power Loader in Aliens (1986), which affected the mechanical, industrial appearance of limbs and joints. I also looked at Cyberpunk environments and Halo's iconic helmet visors, which extended the concept of functional glowing emissive strips and the mech's streamlined facial panel. The Tesla Cybertruck was a constant presence throughout, with its faceted surface language providing the tone for the look overall.

Workflow-wise, this project employed a specified pipeline starting from concept sketching in Photoshop, proceeding to block out modelling using 3DS Max, high detail sculpting, UV unwrapping, texturing using Substance Painter and final rendering in Marmoset Toolbag 4. I further baked the high poly model onto a low poly one to create game-ready textures, and exported the finished mesh as an STL to 3D print the model, thus giving the pipeline a physical output layer.

This project significantly tested my skill set. I improved my 3D model skills, specifically learning hard-surface topology and edge flow. I became more streamlined in UV unwrapping, with few seams and optimized texture space usage. Substance Painter texturing taught me to layer dirt, edge wear and emissive to produce realistic surface detail. In Marmoset Toolbag, I constructed much more understanding of real-time lighting, depth of field and composition - this improved the quality of my beauty renders.

I also gained a clearer understanding of the distinction between different roles in the industry. As a 3D artist, I was involved in modelling, UVs, baking and rendering. Initially, however, I was a concept artist, exploring direction for design and storytelling through silhouette and sketching. This helped me to realize how roles overlap in tight-knit production teams and helped me understand where I may want to further specialize.

EVALUATION AND REFLECTION EVIDENCE – OVERALL PROJECT EVALUATION

Compared to professional quality in my work and games such as War Robots or other mech games on both mobile and PC, I can see that the project holds up relatively well in terms of design consistency and presentation quality. Silhouette legibility is high, detailing level appropriate, and the model would fit well into either stylized or semi-realistic game art directions. The quality of rendering, particularly with ray tracing on in Marmoset Toolbag 4, assisted in taking the visual accuracy to a level that is both professional and refined.

However, there were some limitations. As mentioned above, the low poly version was far too aggressive in optimisation in certain areas, causing angularity that affected surface smoothness. Secondly, the model wasn't rigged or animated, which limits its application in a live gameplay environment. A full rig and animation pass would be required to demonstrate motion, weight, and interaction with the world. Additionally, the actual physical 3D print was successful but hand painting it takes it to the next level for improved presentation.

In a production environment, this model could be used as a game-ready asset after some adjustment. With a better optimised low poly mesh and neat rig, the CyberMech can be used as an NPC or player unit in a real-time strategy or third-person shooter game. The modularity also makes it ideal to use in customisation systems, with weapons, heads, or limbs being upgradeable or interchangeable.

Overall, this project has played a key role in shaping me into a specialist 3D artist. It gave me total control of an idea from initial conception to digital and physical execution and refined technical and creative procedures. The use of computer modelling, real-time rendering, and 3D printing also increased my understanding of how assets travel through pipelines - from concept piece, through game model, to portfolio work - and enhanced my dedication to a hard-surface modeler and sci-fi asset career.

Bibliography:

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Figure 3: https://www.youtube.com/watch?v=KL7yiJ7Z7_U

Figure 4: https://depositphotos.com/photo/battle-robot-rendering-battle-robot-204210342.html

Figure 5: https://www.deviantart.com/marcelosilvaart/art/Cyberpunk-Robot-Concept-Art-by-Midjourney-942938224

Figure 6: https://www.artstation.com/artwork/gR8z1P?album_id=10158963

Figure 7: https://edition.cnn.com/2019/11/22/cars/tesla-cybertruck-electric-pickup-truck

Figure 8: https://www.artstation.com/artwork/eaDgGb

Figure 9: https://www.artstation.com/artwork/ALZgq

Figure 10: https://www.artstation.com/artwork/L4905

Figure 11: https://www.artstation.com/artwork/L4905