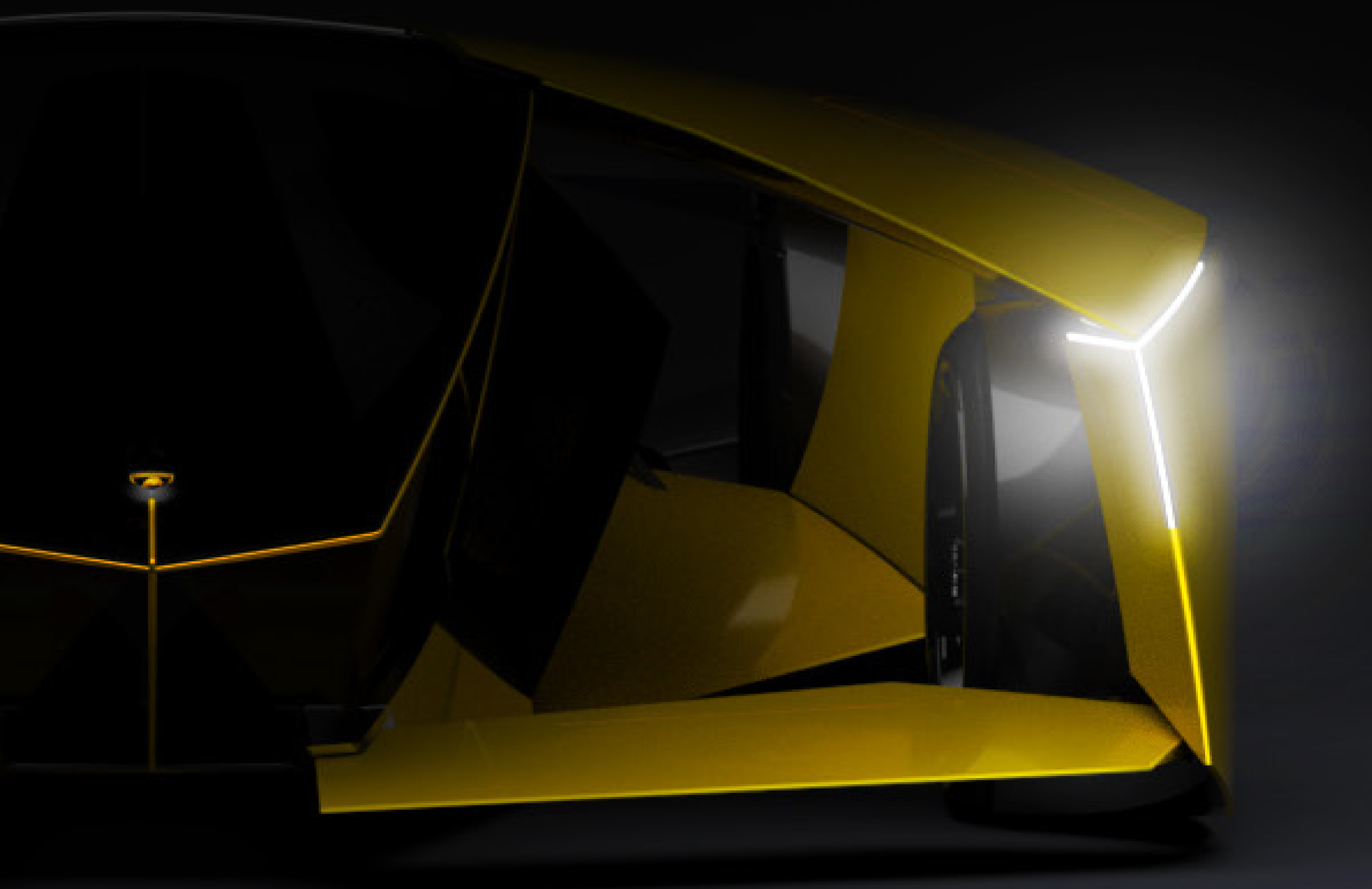
RATÓN



LAMBORGHINI RATÓN

Autonomous Super Car

Lahti University of Applied Sciences
Vehicle Design
Spring 2019
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Lamborghini Ratón, Autonomous Super Car
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ABSTRACT

The task was to design a concept of an autonomous super car for the future. The a final result was a 3D-model of a concept which showcases how autonomy and other future technologies can be used in a super car. Lamborghini was selected as a brand, because it is one of the most traditional of all super car manufacturers. The challenge was to study Lamborghini's design trends and make the concept to look like a Lamborghini.

TIIVISTELMÄ

Tehtävänä oli suunnitella konsepti tulevaisuuden autonomisesta superautosta. Lopputuloksena oli 3D-malli konseptista jossa esitellään ideoita miten autonomiaa ja ja muita tulevaisuudesn teknologioita voidaan hyödyntää superautoissa. Konseptin brändiksi valikoitui Lamborghini, joka yksi perinteisimmistä superautojen valmistajista. Haasteena oli tutkia ensin Lamborghinin muotoilun suuntauksia ja saada konsepti Lamborghinin näköiseksi.

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INTRODUCTION

1.1 SUBJECT

Today the car industry is going through probably the biggest revolution in it's history. The technology that has powered our cars for the last hundred years will not be sufficient in a world of the future. The environmental concerns and peoples changing lifestyles create new challenges for car manufacturers.

The consensus is that the future of a car will be autonomous and electric. Self driving cars make traffic safer and peoples lives easier. Electric motors replace polluting and fossil fuel burning combustion engines with more environmentally friendly energy solutions.

What does this revolution mean for the breed of super cars that have traditionally relied on driving experience, excessive power, loud engine noise, and outrageous looks? Can you have an autonomous electric super car and what would it look like? Does it make any sense at all to have a super car that you could not drive?

For a brand I chose Lamborghini. It is one of the godfathers of the super car and thus one of the most important ones. I wanted to do my project from a traditional brands perspective. In a rapidly evolving car industry and with new innovative companies quickly joining in, it can be challenging to keep an old brand relevant. On the other hand a great pedigree holds big advantages too.

1.2 DESIGN OBJECTIVE

My goal with this project was to design a concept that would showcase design ideas and technologies for super cars of next few decades.

My primary challenge was going to be retaining the appeal of a super car if it is autonomous only. I had to figure out new ways to make the car an exciting experience that would replace the fun of driving and try to use all the advantages that autonomy provides. Also I had to research some of the other technologies that would be relevant from a super cars point of view. The goal was not to invent something completely new, but to see where the car industry and super cars specifically should be headed.

Since I was designing a concept for an established brand like Lamborghini, I had to make sure it would fit in into the brand image. It should look at home when lined up with the rest of the models. While the car should be unmistakeably recognisable as a Lamborghini, it should also bring something new to the design DNA.

Currently, Lamborghini is at their 5. generation of their flagship models. My goal was to make, if not the next one, but the 7; or even 8. generation model. This means some where in the next three decades.

As an end result of my project, I planned on doing a 3D model of my final design with renderings. For the degree show I wanted to do a 3D print and/or an animation depending on the time I have available and which is the best way to show all the features of the vehicle.

2

RESEARCH

www.automobilemag.com

2.1 AUTONOMY

Autonomous cars use cameras, sensors, lasers, machine learning and intercommunication to drive themselves independently. Autonomous cars have many benefits to them and that is why so much is invested to this technology. Autonomy will change the way we think about regular cars, but how much does it change the concept of a super car.

Self-driving vehicles that communicate with each other will relieve traffic jams and make traffic safer by removing the mistake prone human from driving. A lone human driver trying to navigate smooth flowing traffic of autonomous cars can be very hazardous scenario. This is why cities and major roads may allow only Autonomous cars in the future. Reduced risk of crashing means lesser need for big safety structures around the car.

Another benefit with self-driving cars is the time freed up for people to do something else in the car than driving. The car can be designed to more of a cosy room where you go in at one place and then come out at some other place. In a super cars case the focus is on the driving experience itself. If driving is out of the question, there should be some other ways for the ride to feel special.

Today's cars takes people to the services they need, but autonomous cars can bring the services to the people. This means that, for example, ride-hailing will become more feasible option because you don't have to pay for a driver and the car can pick you up more quickly. (Smith, Brett, Spulber, Modi, Fiorelli 2017)

Exclusivity is a big part of the appeal of a super car. They are more of a collectable items than just something you use and then forget about. The exotic super cars should not just be self driving taxies. They should provide something special for car enthusiasts like exclusive track day or road trip experiences for example. The cars could also be privately owned by collectors just like today.

Terzo Millennio is a Lamborghini's concept car which explores the use of autonomy on sports cars. The technology in this car is still quite primitive when compared to my design objectives, but he technology is going to develop fast in the future.

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2.2 GRAPHENE SUPERCAPACITORS

Maybe the primary bottleneck of the development of electric vehicles is their energy storage technology. Currently, our lithium-ion based batteries require a large amount of space in the car, use toxic materials, wear out in use and they take a long time to charge up.

One potential replacement is carbon nano tube supercapacitors. Supercapacitors are electricity storages that have very high power density which means that they can be charged and discharged in seconds. This is ideal for regenerative braking for example. They don't wear out as lithium-ion batteries do, so they have a much longer life span. However, unlike lithium-ion batteries, Supercapacitors of today have very low energy density which means they can store a very low amount of electricity. (Woodford 2018)

There has been al lot of research to find materials that could increase the energy density. One of the new wonder materials is graphene. Supercapacitors made out of graphene nano tubes have the same properties than regular supercapacitors but in a nano-scale so you can stack them up to create similar energy density to a lithium-ion battery. (Guerra 2016)

Many racing cars like Toyota TS040 Hybrid for example have used super capacitors as a short term energy storage for fast energy deployment and recharge. However with road cars longer term energy storage is needed. Supercapacitors made from graphene can store enough energy for hundreds of kilometres instead of one straight on a race track of regular supercapacitors.

A quite big supercapacitor pack might still be needed on the car, but It could be made smaller depending infrastructure around the road network. For example, if in the future, we have wireless fast-charging stations that could be used while moving, the car would need less range and the user won't have to think about charging at all.

This kind of graphene nano tube supercapacitor technology is still in its infancy and could be expensive at first, but a high-tech super car may be a good candidate for an early adaptor.

Toyota TS040 Hybrid from 2014

wpblink.com

2.3 HUB MOTORS

www.autoblog.com

An example of one hub motor concept from Protean Electric

The idea is to pack the electric motor to the Inside the wheel or even to integrate the motor into the wheel itself. By having a motor on each wheel, you get the benefits of all-wheel-drive and with advanced torque vectoring system which can adjust the power output to each wheel. Unlike big combustion engines of today or even smaller chassis mounted electric motors, the hub motor frees up a lot of space in the chassis of the car. This allows more freedom when designing a layout for the car.

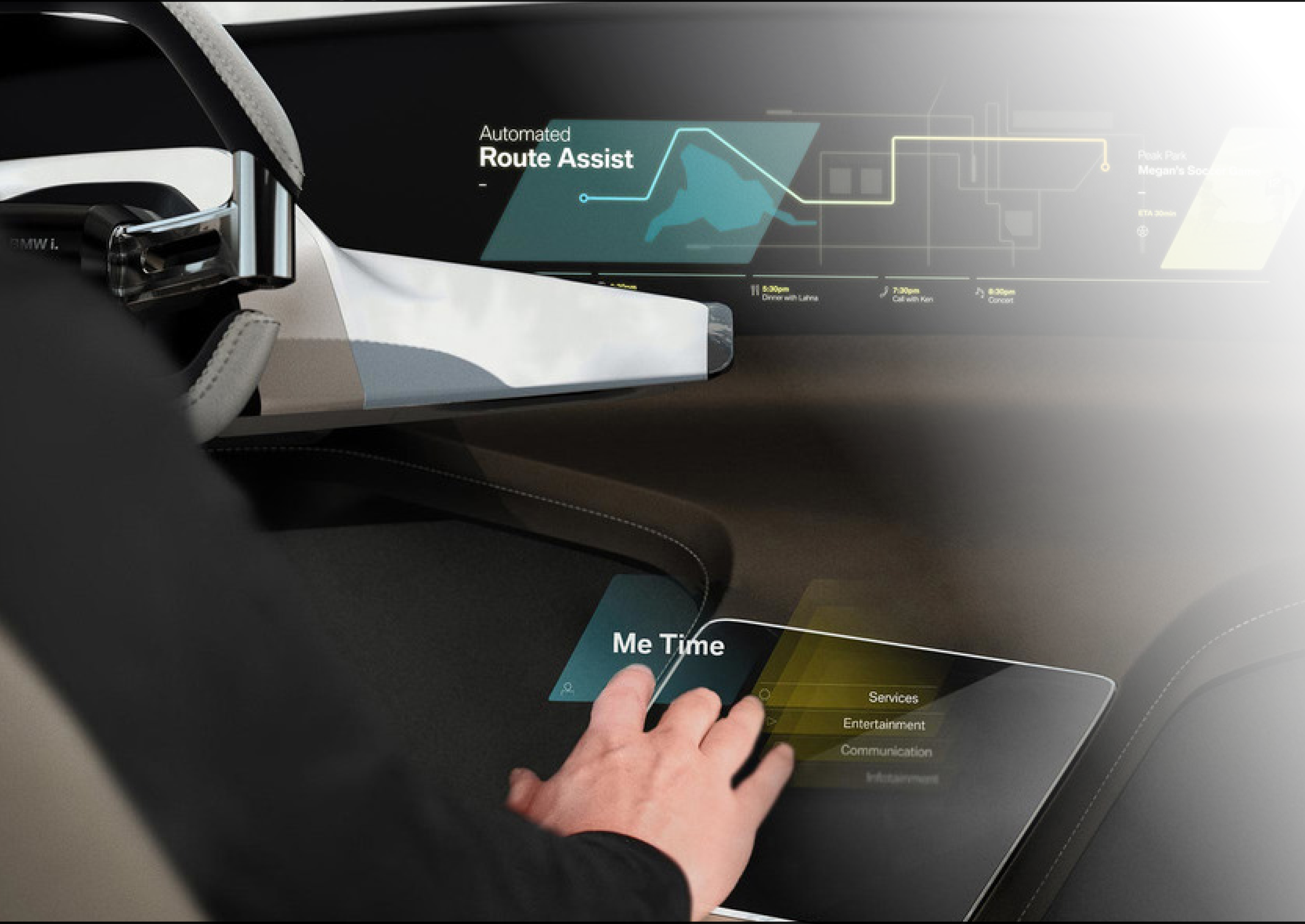
The great drawback of a hub motor is increased unsprung mass. This affects car handling negatively which is especially bad news for any kind of a sports car. However, this problem can be at least partially solved by active suspension systems for example. (Fraunhofer-Gesellschaft 2010) Another concern is the power output related to mass which at this moment is not enough for a high-performance car, but it could be improved significantly in the future.

In my project's case, the extra space freed by wheel hub motors would be used mainly for aerodynamic purposes. Letting air go through the car rather than around it provides more clever ways to create downforce or reduce drag.

www.netcarshow.com

For example the petrol-electric hybrid engined Aston Martin AM-RB 001 (Valkyrie) already uses openings in the chassis to redirect air. With the extra space freed up by hub motors, this idea can be taken to a new level. For example, the diffuser area which is crucial for creating downforce will not be limited by drive shafts, gearboxes or any other components. In theory, the space between rear wheels is completely free for use.

2.4 AUGMENTED REALITY



The big trend with car interiors today is touch screens and they are littered all over the dashboard. Alternative technologies for UIs are already in development. Augmented reality is a term for computer-generated images that are projected to users' surroundings (Realitytechnologies). With cars UIs all the information you need can be projected onto the windshield or inside the cabin with holograms in 3 dimensions. The holograms can be used as a user interface just like touch screens today by gesture sensors. You can even apply haptic feedback onto the UI with ultrasonic speakers. BMW has already showcased this kind of technology with their i Inside Future concept. (Beaumont 2017)

AR allows for a new way of thinking when designing an interior for a car because you don't need to worry about physical buttons or touch screens. You can go as far as getting rid of the physical dashboard completely and have the UI on only when needed.

◀ i Inside Future

www.motor1.com

2.5 SUPER CARS

The definition of a super car is quite loose, and people tend to have varying ideas about what the term means. Excessive power, wide size, huge price, those are some of the characteristics that all super car share. They sacrifice practicality for the ultimate driving experience, performance, and styling. Super cars are something that people want but never really need. It doesn't matter if you are young or old, a super car should make you feel like kid again.

Super cars have a deep connection with car racing. Even some of the biggest brands of today like Ferrari and McLaren were born from motor racing. Both super cars and racing cars share the same ambition of going as fast as possible, so it is natural that a lot of the technology developed for racing have trickled down to super cars.

Supercars are often called racing cars for the road even tough in reality this is rarely the case. Whereas racing cars take no compromises on going fast around a circuit, super cars need to meet the demands of casual everyday use like comfort and durability. They usually are roadcars first and racing cars second.

Super car as a segment fall somewhere between racing cars and luxury cars. With exotic materials and cutting-edge technology there is a certain sense of luxury. Whereas a true luxoury sedan like Maybach for example provides comfort and peace to the people inside, a supercar offers exitement not only to the people inside but all people around as well. They are just as amazing to look at as they are to drive.

The demographic varies depending on the price tag and exclusivity of the product. The cars whose value is measured in millions and production numbers in hundreds are bought normally by self-made men whose collection might also include 30 other cars, yachts, private planes and houses (Zhang 2018). With the more affordable models the demographic get larger and more diverse, from any one from lottery winners and kids with rich parents to car enthusiasts who just can afford a super cars.

Standing out from the rest is one of the side effects of having a super car. They will turn people's heads and gather up crowds when parked. Most owners are used to this and some even like to amp up their cars exclusivity by personalising their cars. Some people use their supercars more like expensive piece jewlery that you rather wear than drive.

2.6 LAMBORGHINI

The story has it that when Ferruccio Lamborghini, after earning fortunes as a tractor manufacturer, bought a Ferrari and was disappointed with its performance. He wanted to show that he could do better and started to manufacture his own cars. (Sparke 2005, 177)

The origin story is fitting, because Ferrari was already in the 60's the pinnacle of Italian sportscars. Naturally they were the main benchmark for Lamborghini. Ferrari was born from racing engineering and was already very established name in the business. Lamborghini did not have that tradition, so they had to rely on making evermore flamboyant and outrageous designs to get the attention.

In order to make the car look like a real Lamborghini, I had to take check some of the design features of older models. I tried to find common themes but also see what new each model brought to the table.

In 1966 the Lamborghini Miura was launched pencilled by Marcello Gandini. It changed the game of sports car design with mid engined layout and a low and wide body design.

girardo.com

With Countach from 1974, Gandini created the classic template for Lamborghini's super cars.

thoughts.onthedash.com

2.6 LAMBORGHINI

en.wheelsage.org

Murchielago from 2001 captured the essence of all the iconic design features Lamborghinis are known for. Being the first new model under Audis ownership, it brougt a touch of elegance to the Lamborghinis slightly rebellious frat boy image with its cleaner more minimalistic design. While having cleaner and more minimalistic approach, it still is just as dramtaic as its predecessors.

For my design I wanted to incorporate this mix of elegance and dramatic shapes.

Reventon, which was based on Murchielago, was inspired by stealth aeroplanes. It influenced later models with it's angular design.

www.topgear.es

Aventador Is the latest incarnation of Lamborghinis flagshipmodels. It amped up the agressiveness and sharpness

www.motorauthority.com

2.7 NAMING A LAMBORGHINI

With few exceptions, traditionally the names of Lamborghini's production models come from the world of bulls or bullfighting in particular. It is a very controversial subject because of concerns about animal cruelty, but I think will still fit with Lamborghini's more rebellious image, even in the age of political correctness.

Ratón was the most famous fighting bull of recent years. He injured dozens of people and fatally gored three during bullring events around Spain between 2006-2011. Normally a bull is retired once they get blood on their horns, but Ratón was just too popular and valuable to stop performing on the festivals. People would pay up to five times more to see the fearsome killer bull with a white triangle on his forehead. Eventually, Ratón had to be retired after safety concerns. After his death he was taxidermied and is now on display at the owners farm near Valencia.

Ratón (mouse) got his name for being very small at birth but later the half-ton bull earned his fierce reputation at the ring with his agility and speed. (Hadden 2015)

Ratón hunting down a brave runner at a Spanish bull running event called "Bous al carrer"

www.wsj.com

3

INSPIRATION

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3.1 STREET LUGE

Created by fearless skateboarders who liked to ride downhill on their boards while laying down, the street luge is a sport for a true thrill seeker. Speeds can hit about 100km/h and riders are sitting only few centimetres above the asphalt. The sport can be performed on any road or pavement where there are some hills to ride down. Races are held on a closed road sections. (Turner)

Even tough street luge is controlled by the rider, a lot of its appeal comes from the sense of speed and danger. I wanted to capture some of the excitement by implementing elements of the street luge into my design. Imagine if a street luge had an engine with 1000 horsepower?

www.abenakiextreme.com

www.emaze.com

3.2 BULL

Today bulls are closely associated with Lamborghini. Ferruccio himself had a fascination of bulls since he was born under a Taurus star sign. He also used bull as a logo for all of his industrial ventures. Miura was the first bull themed name of Lamborghini's car models. It is the most renowned breed of all fighting bulls. They are known as the strongest, fiercest and the most intelligent breed. (Lamborghini)

I decided to use a bull as my visual inspiration. I wanted my cars design to have the same powerful forward attacking character just like a charging bull has.

www.youtube.com

www.ecoticias.com

www.maxim.com

3.3 JET FIGHTER

Jet fighters are no strangers when it comes to inspiration for a Lamborghini design. There are also other connecting themes with fighter planes and my project. Today's fighters rely heavily on computers to aid the pilot. Fighter planes of the future are pilotless either controlled from the ground or are completely autonomous.

I wanted the car to make you feel like a jet pulling high G-forces and sudden manoeuvres. This would be very demanding for the technology controlling the car, but for the aerodynamics too. For my design I looked for similar razor sharp edges and sleek surfaces.

Lockheed Martin F-22 Raptor
Is considered the most powerful
fighter in use today (Tajima 2018)

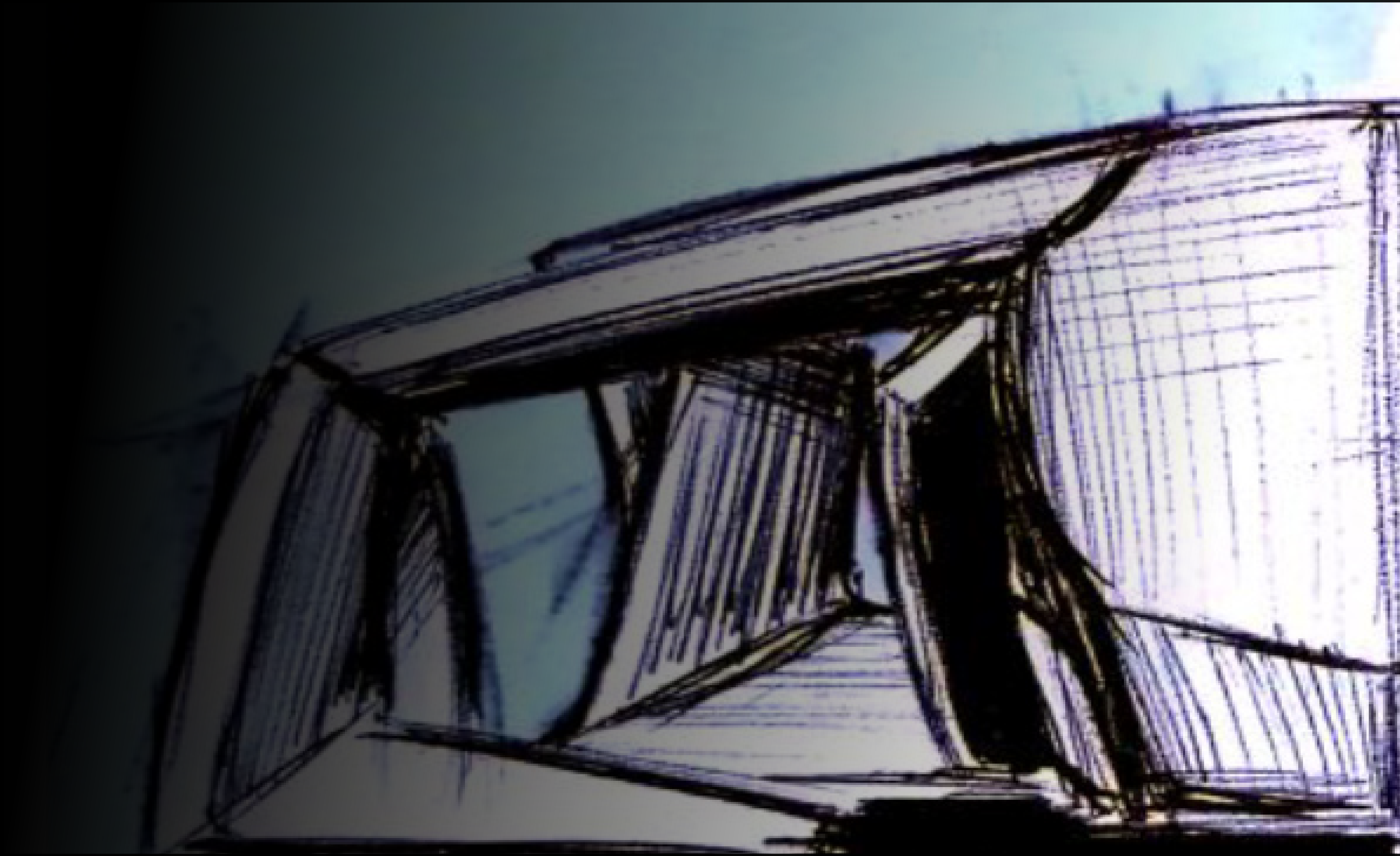
asia.nikkei.com

www.riverfronttimes.com

Boeing Phantom Ray is a fully autonomous stealth fighter protype

4

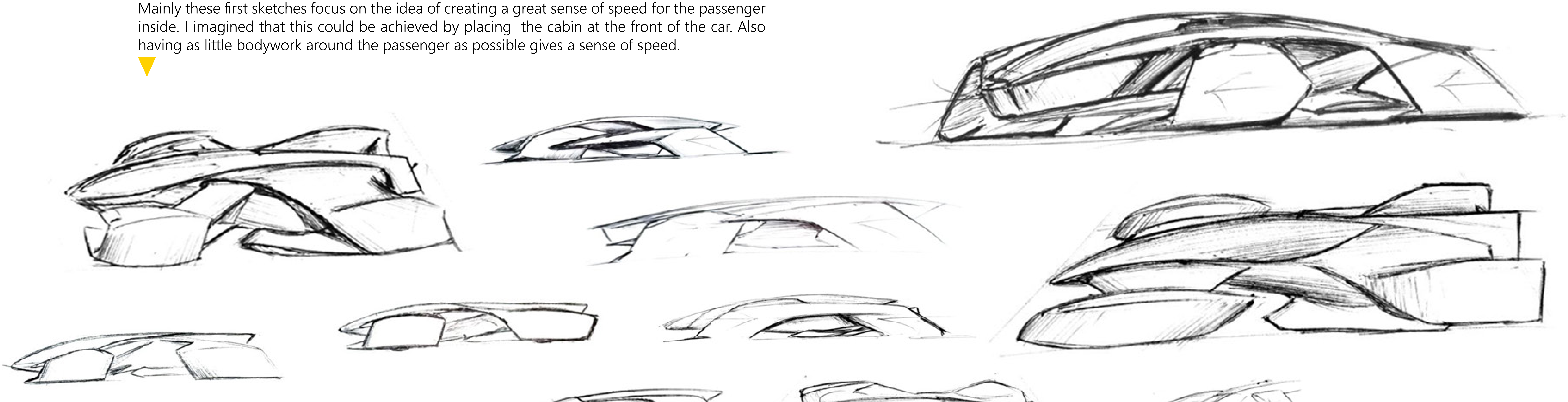
SKETCHING

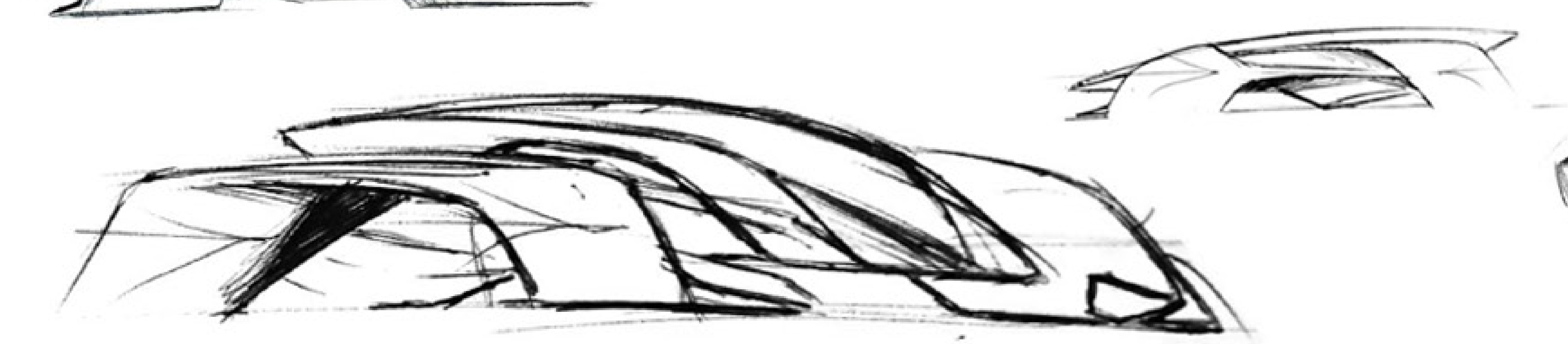


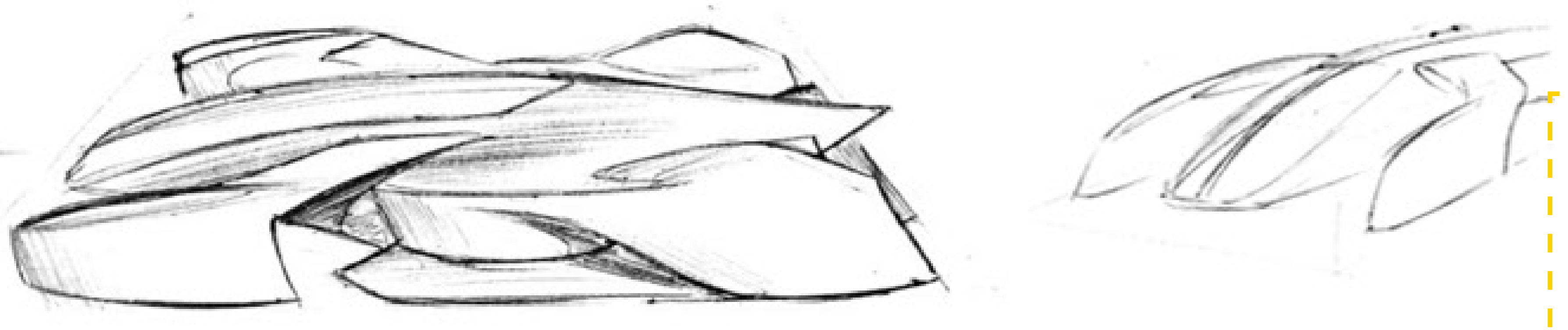
4.1 IDEATION

Many of the first sketches were made before I had chosen Lamborghini for my brand. I just sketched what ever came to mind. It is easy to tell that I was very influenced by various racing cars and fighter jets.

Mainly these first sketches focus on the idea of creating a great sense of speed for the passenger inside. I imagined that this could be achieved by placing the cabin at the front of the car. Also having as little bodywork around the passenger as possible gives a sense of speed.



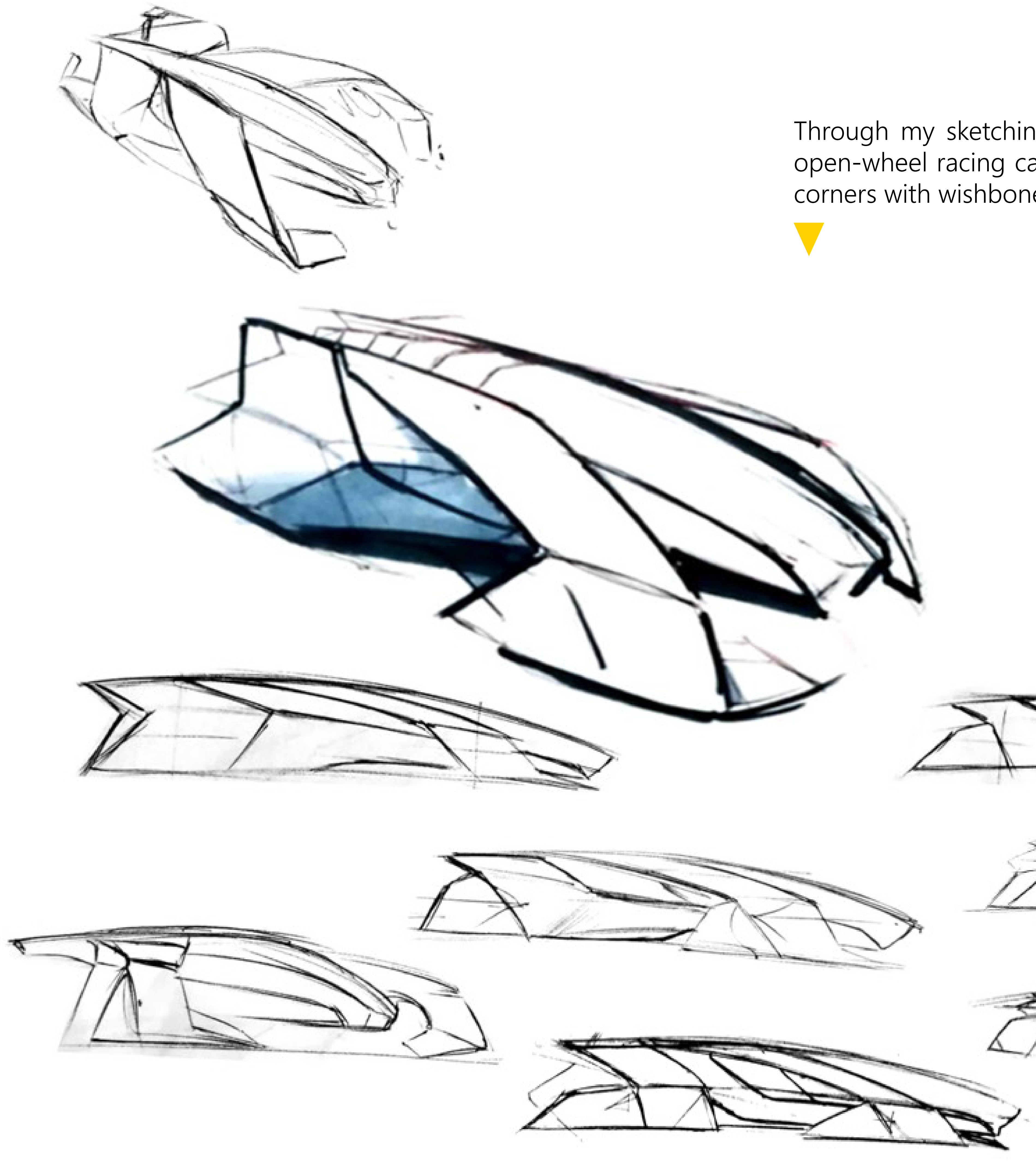




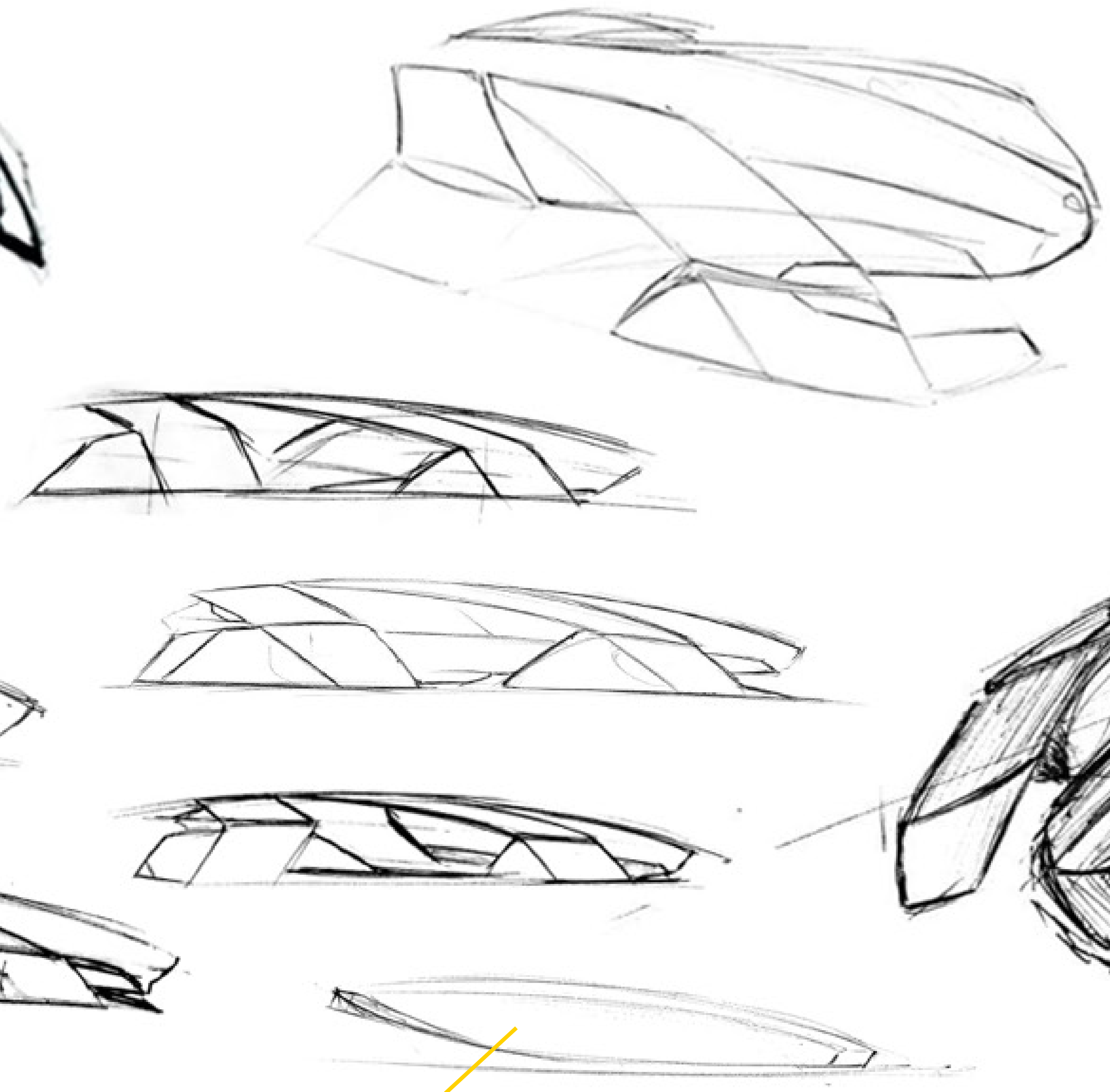
Key sketch

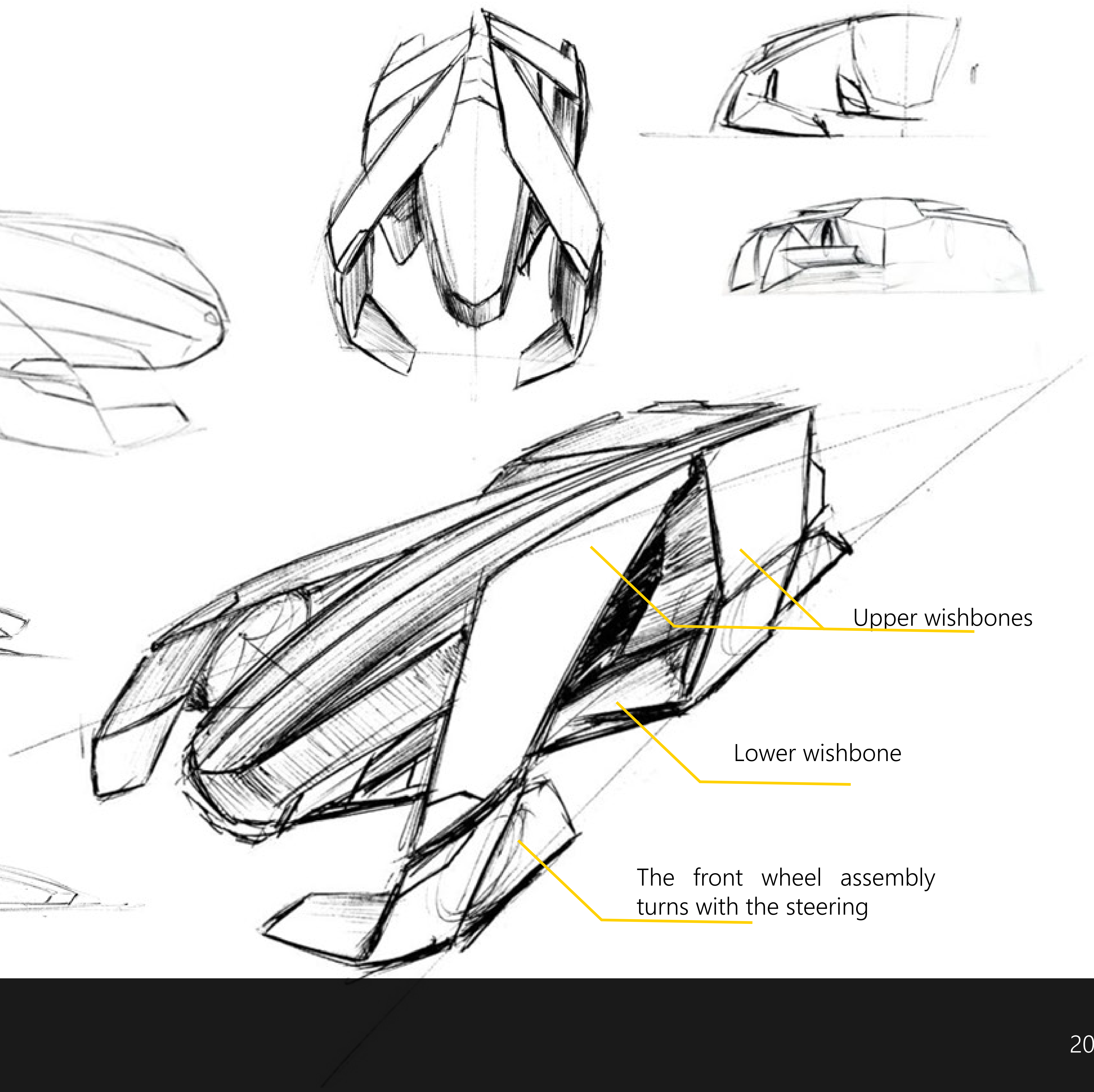
At some point after choosing a brand for the car I came up with this simple sketch. It has a sort of a horn like shapes attached to the top edge of the roof. They form a very Lamborghini like low and flat roof. I liked this Idea so I started to make some better sketches.

4.2 IDEA DEVELOPMENT

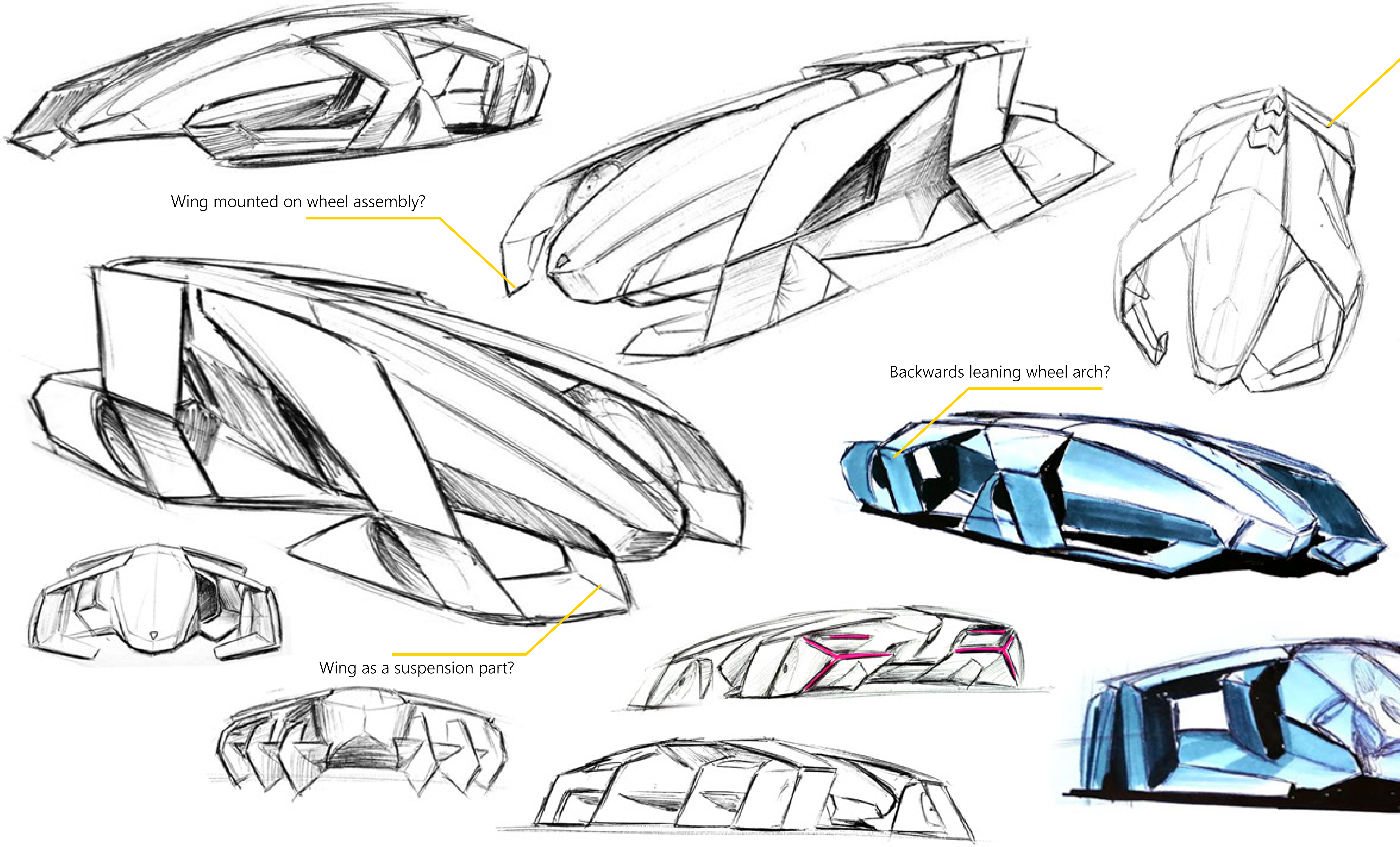


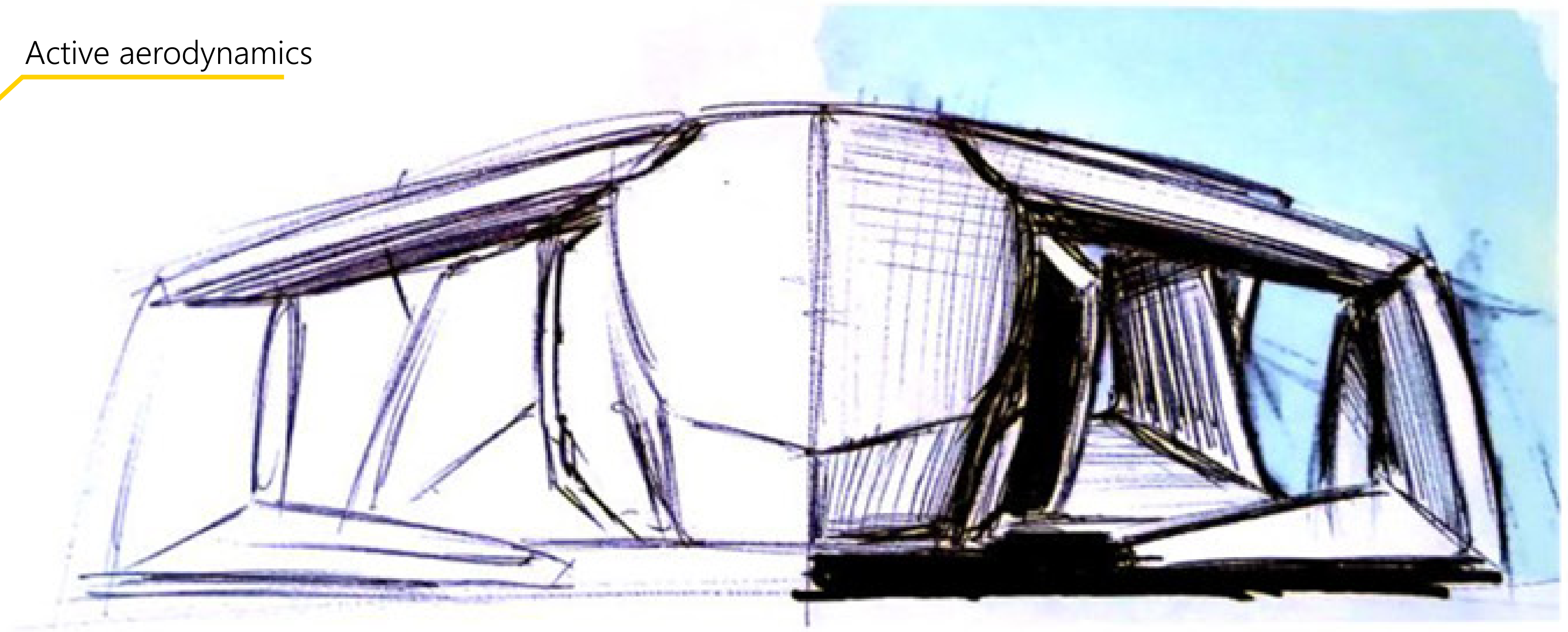
Through my sketching the form changed more and more into a classic open-wheel racing car layout: A monocoque in the middle, wheels in the corners with wishbones in between.





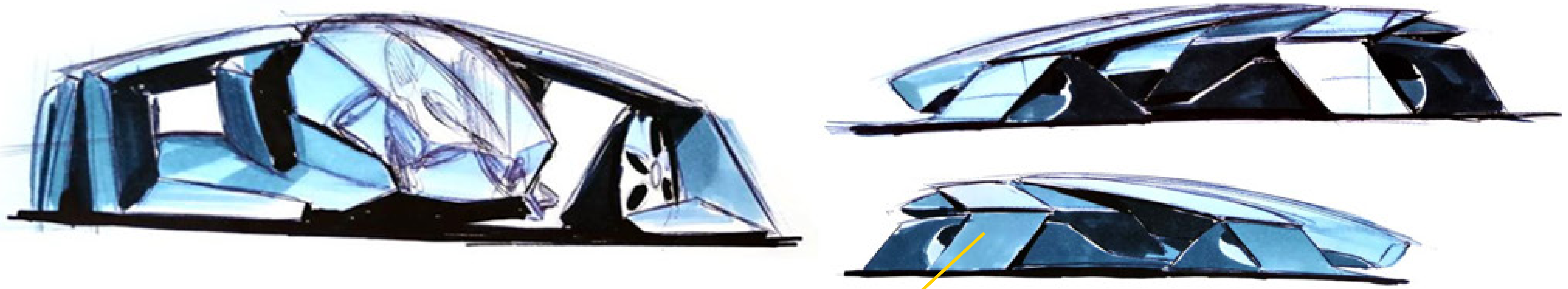
The final form was starting to take shape. Even tough I had pretty clear idea of the overall shape there was still many design choices to be made. There was still few different options for the shape of rear wheel arches, the front wings and the floor for example.



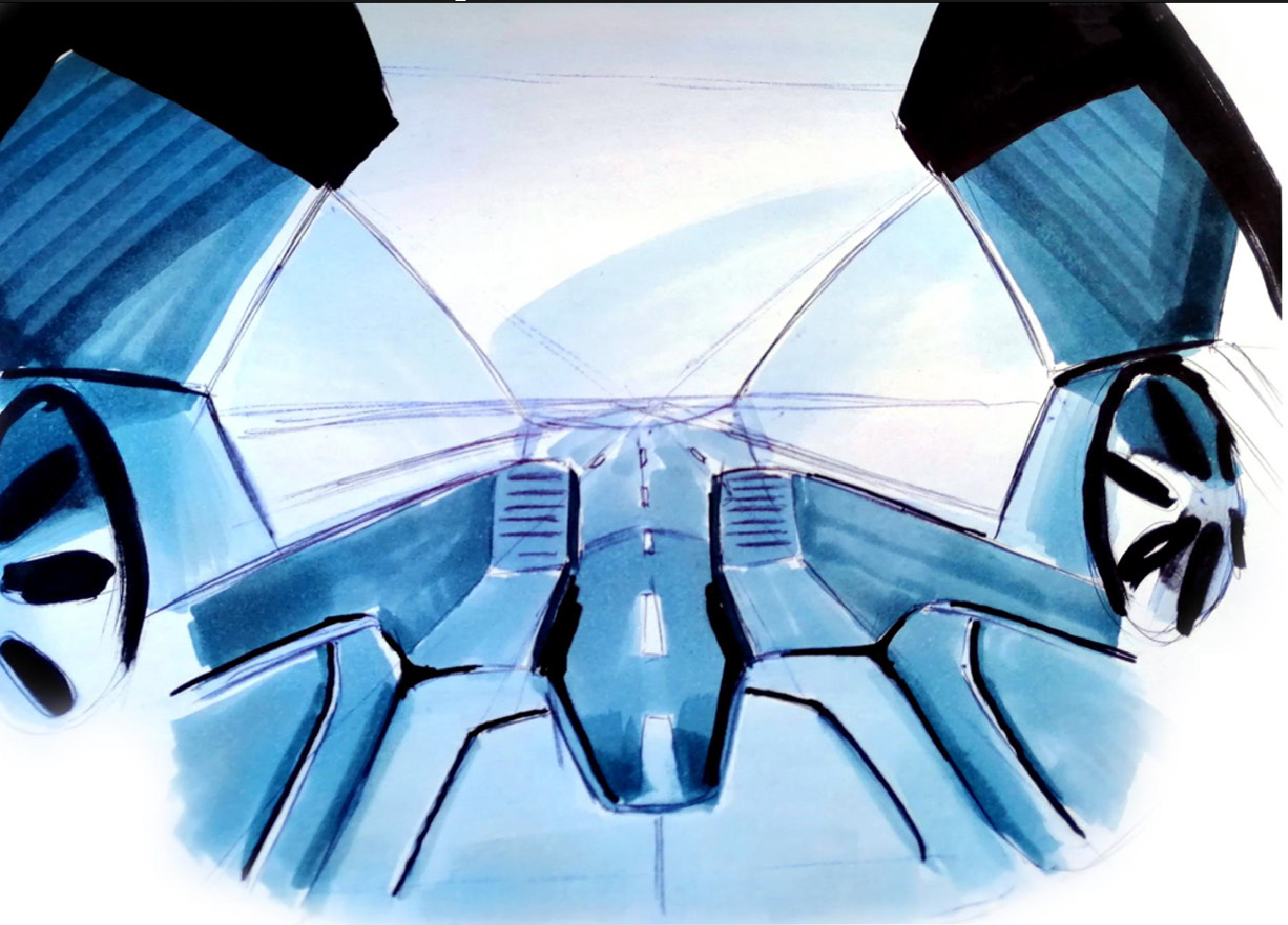


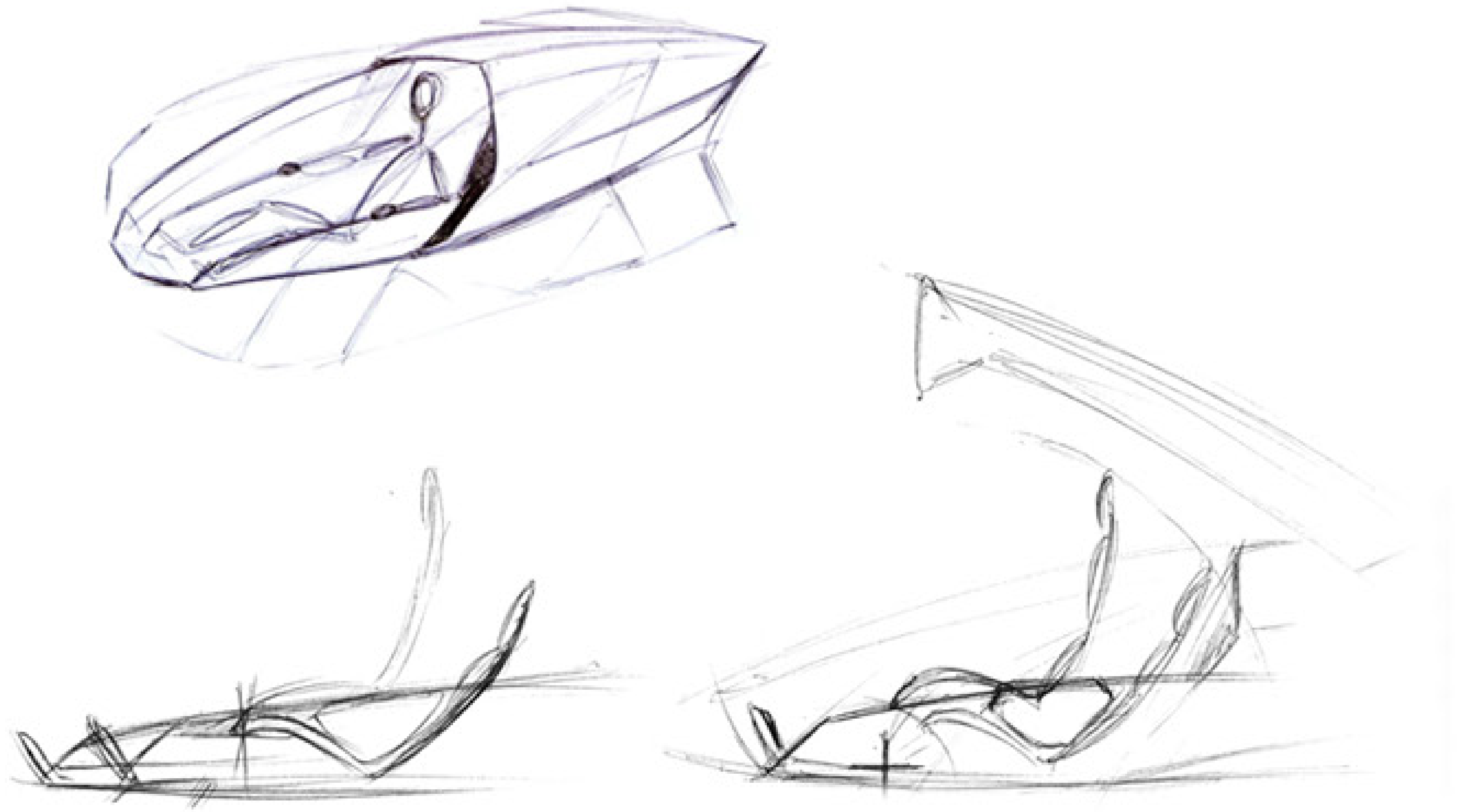
Key sketch

I chose a sketch on which my final design would be mostly based on



4.4 INTERIOR





Doors

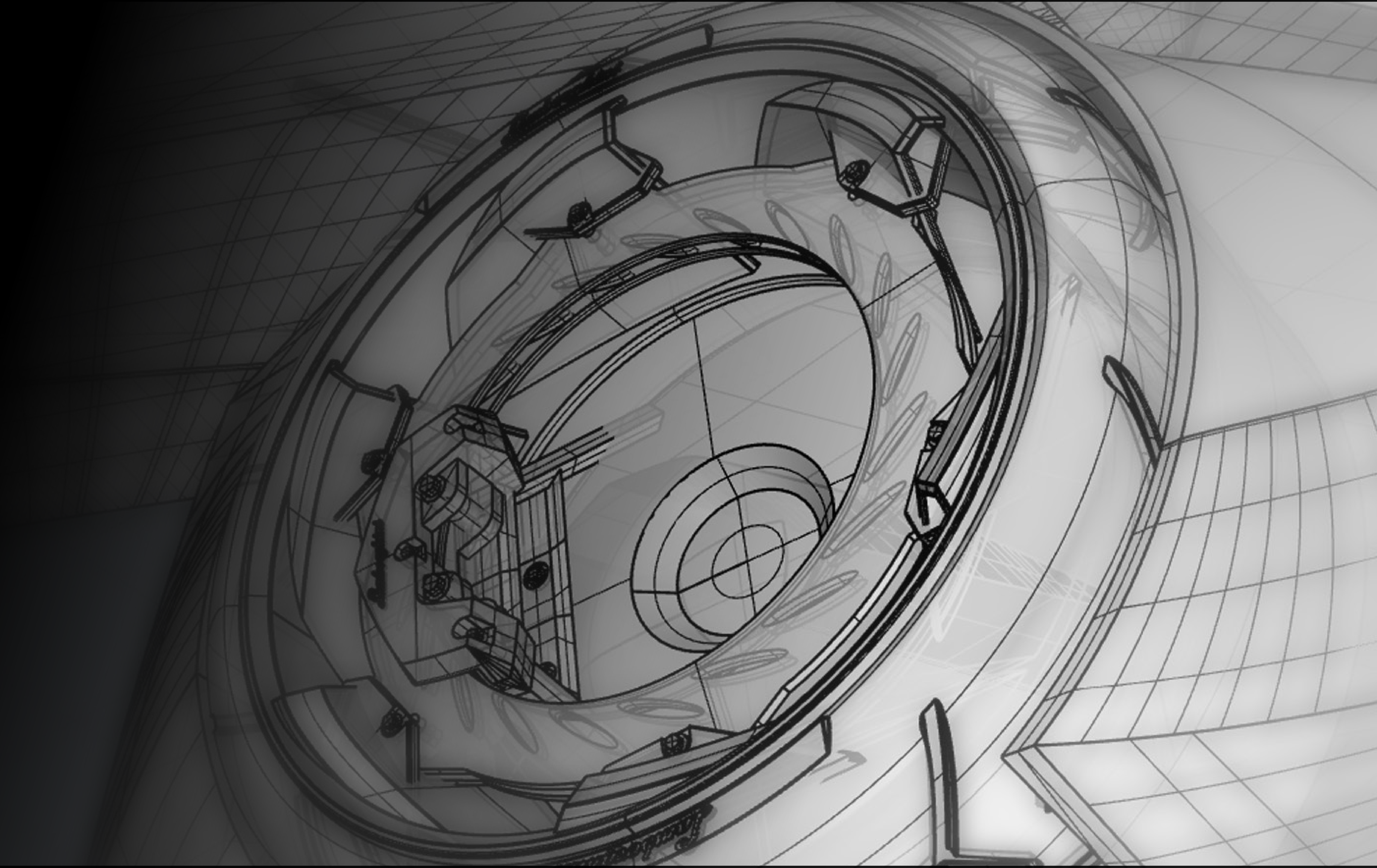
The car would be accessed from the front because there would not be room for normal doors on the sides. Because of the very low sitting position I started to design a seat lifting mechanism in order to make getting in and out easier.

Sitting position

I would keep the interior very simple and concentrate on the view that the passenger will get. The whole user interface will be created by augmented reality so there is now need for a dash board or any physical buttons There is cut out on the floor so the user can see the road running by between the legs. The wheels are turned inwards so the user an admire the spinning wheels and the brakes heating up when braking.

5

MODELING



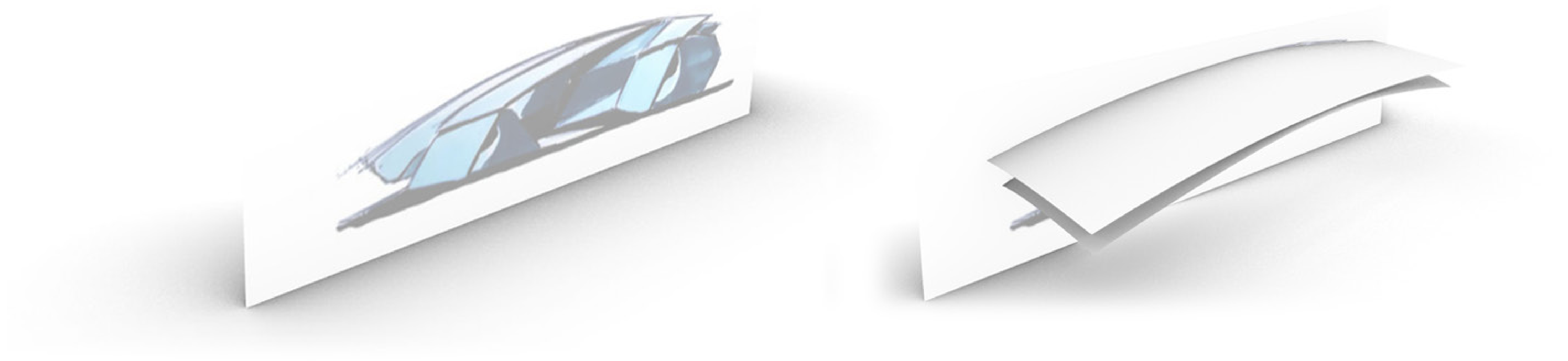
5.1 PROPORTIONS

Since my design was not really shaped like a regular car, I felt like I would get a better sense of the shape in 3 dimensions so, after our sketch seminar, I started to do some modeling.

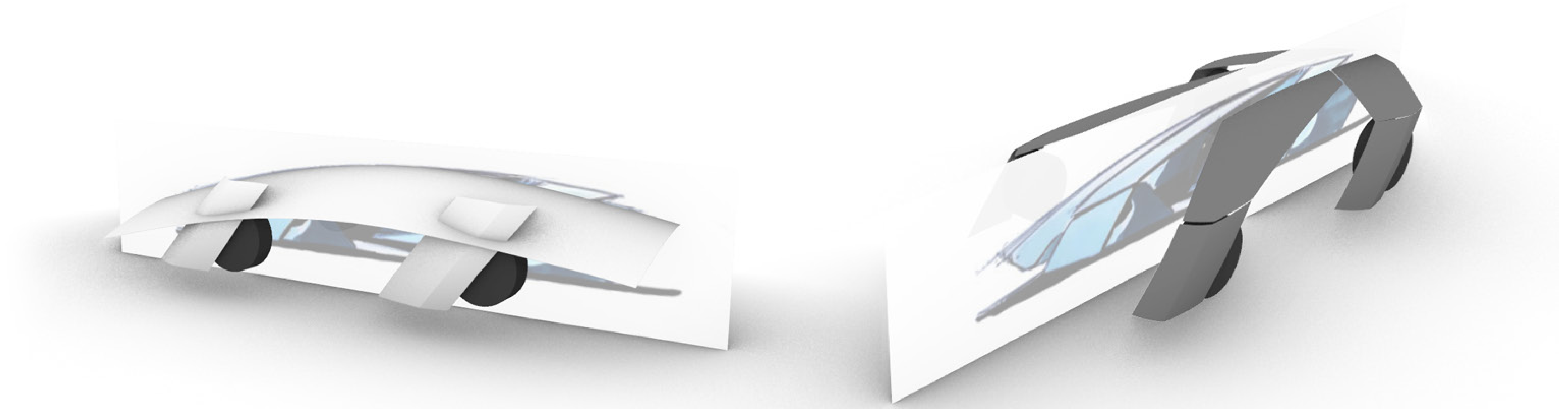
For software, I chose Rhinoceros 3D because It was already familiar to me and I had done a few other projects with it before. Also, I thought I would not waste any time learning new software from scratch.

My sketches weren't that accurate yet and many things were still undecided, so I could not do the final model right away. My plan was to try out different shapes, proportions and new ideas in 3D and continue the design process that way. I knew it was going to be a long and slow process but hopefully worth it in the end.

I started modeling by laying my chosen side view sketch as a rough guideline. Creating a surface along the silhouette of the sketch. The whole top side of the car would visually follow this surface.

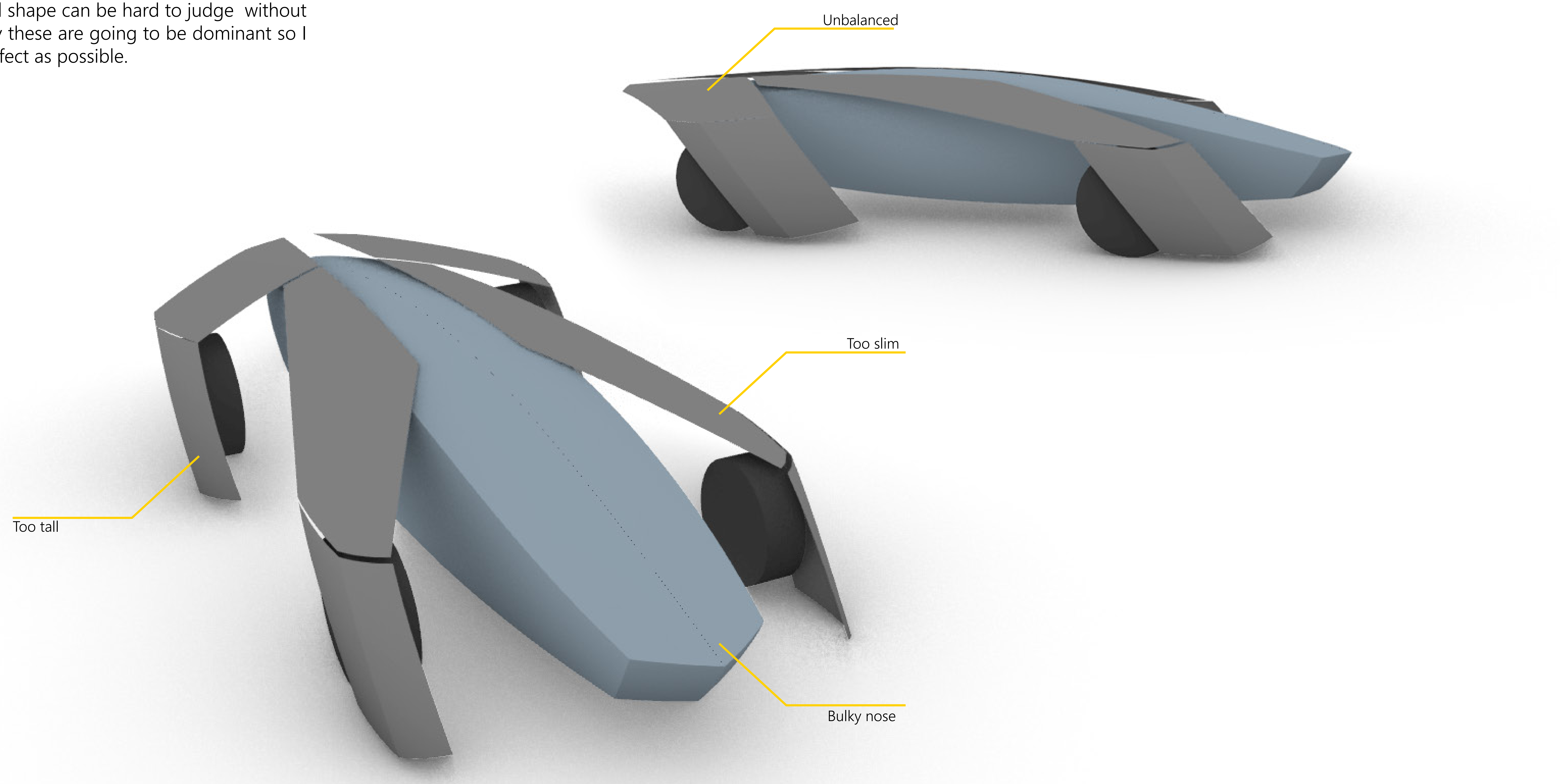


Next I created the wheel hub surfaces. I cut everything into shape and then made the monocoque section to see if this could be a good starting point for rest of the model.



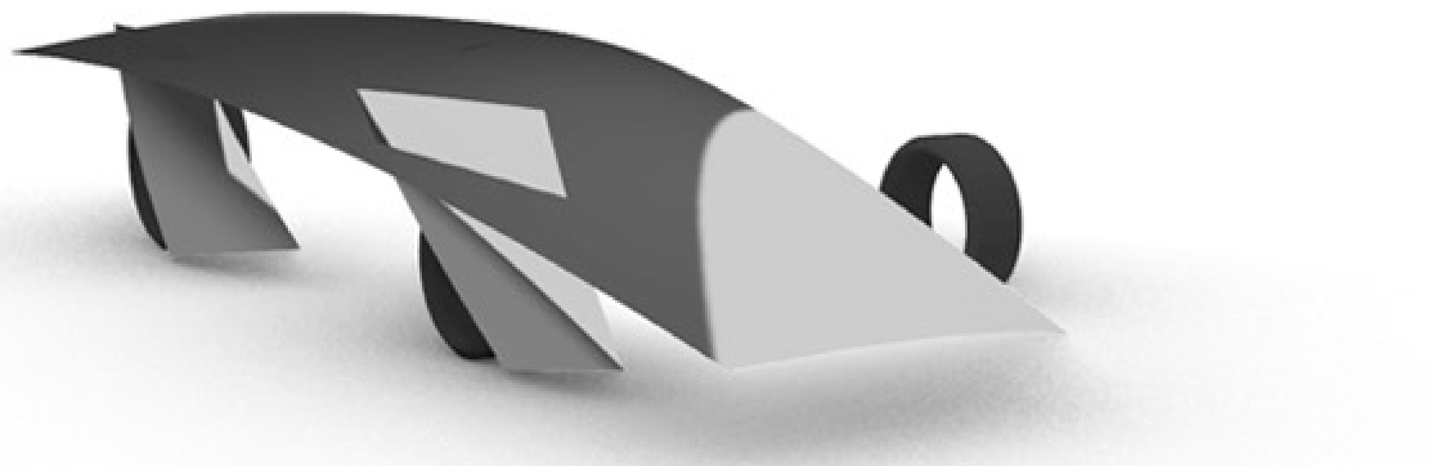
5.1 PROPORTIONS

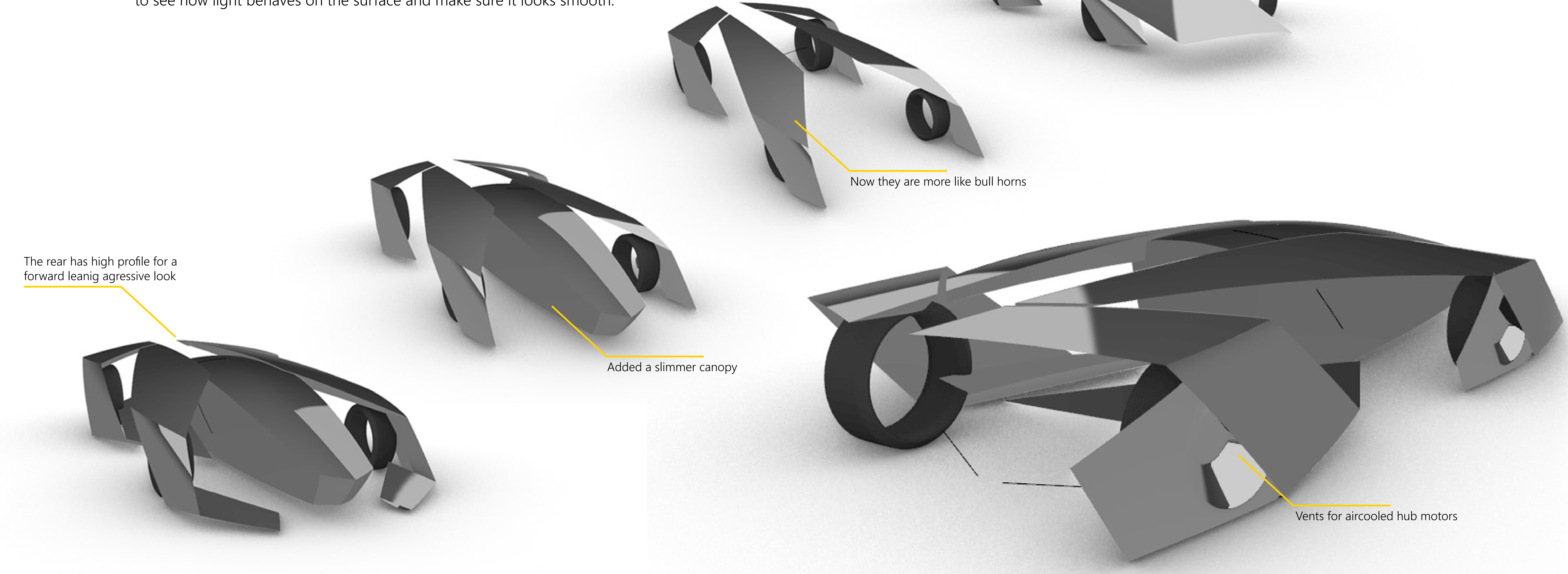
The model looks quite bullish to me, but it's just not good looking enough. This, like many other early versions got scrapped. The overall character of he final shape can be hard to judge without all of the parts, but visually these are going to be dominant so I wanted to get them as perfect as possible.

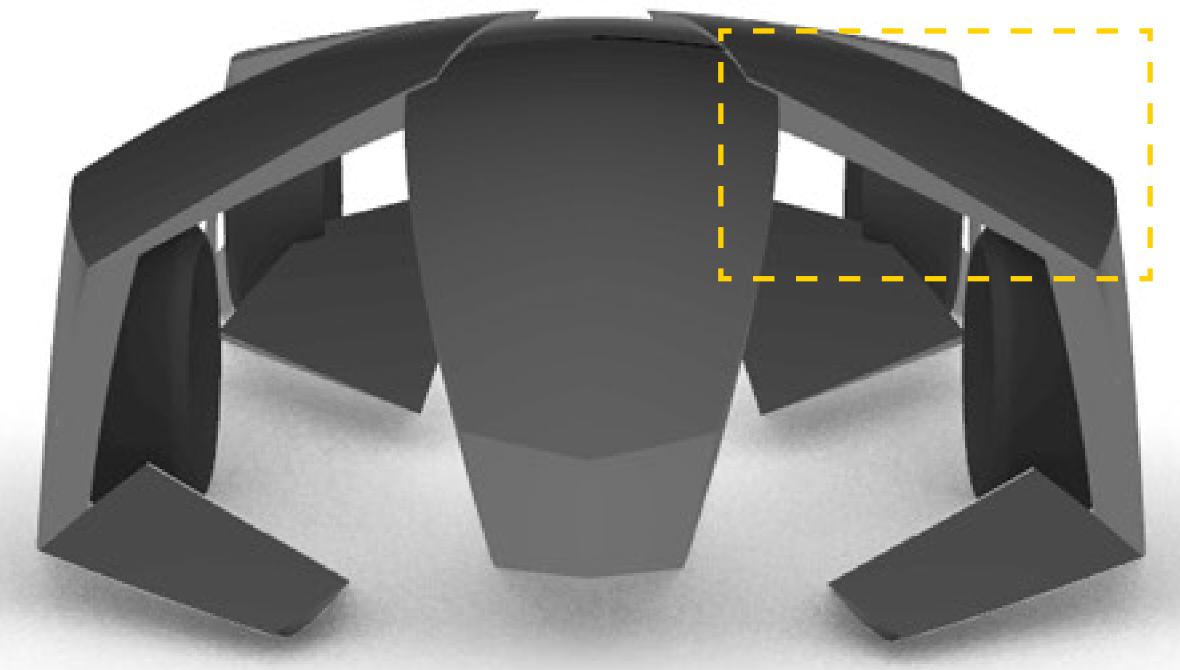


5.1 PROPORTIONS

Trough some trial and error I finally started to get the shape I was looking for. This version started to look more low and mean just like a Lamborghini should. I did less improvisation and trusted more my sketches. Instead of more detailed shapes I focused on doing well proportioned big surfaces which I could change later if needed. I switched the material to shiny metal to see how light behaves on the surface and make sure it looks smooth.





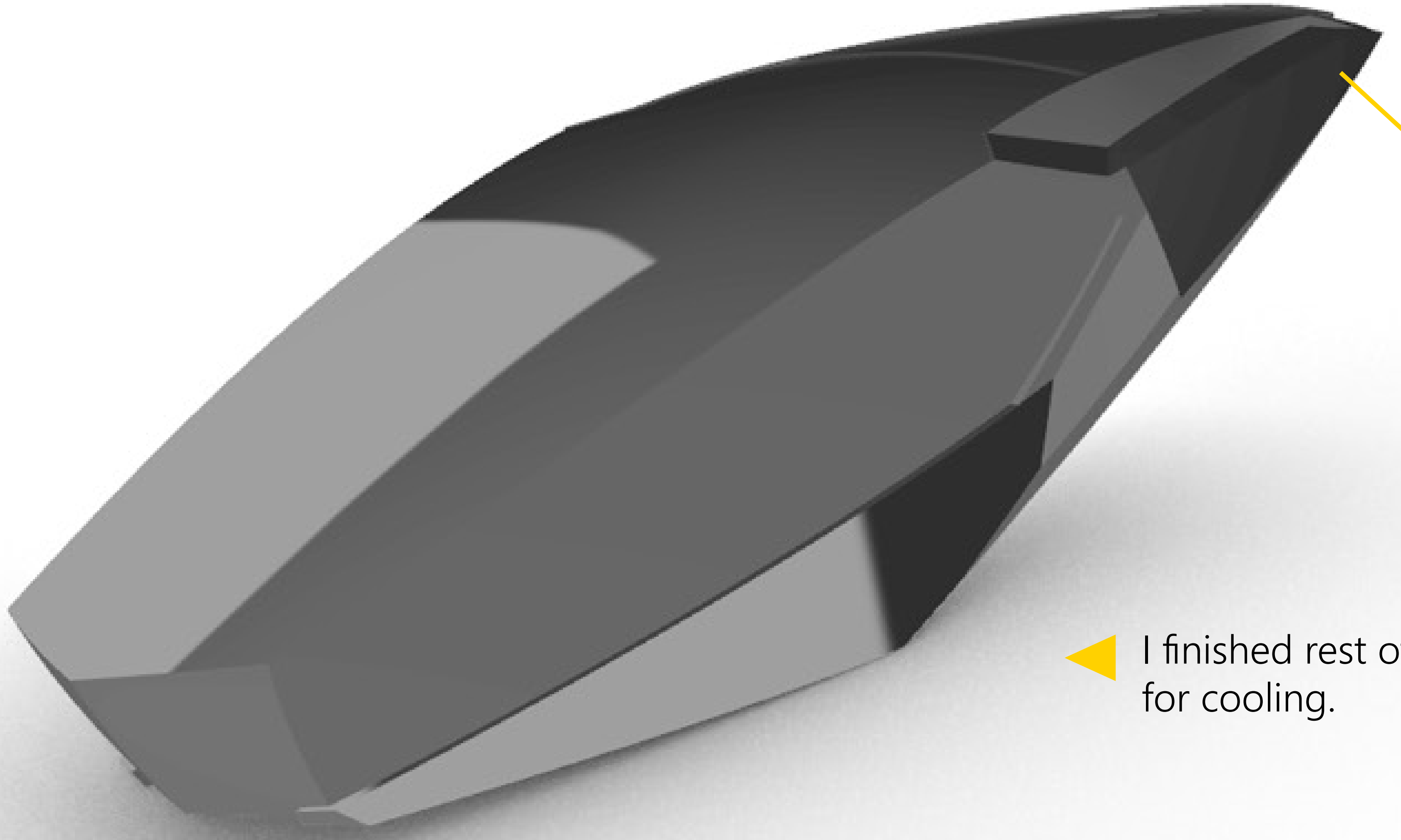


Upper wishbones

At fist I made the upper wishbones quite thick so they would not look too weak. Then especially after the addition of the lower wishbones they started to look too massive so I slimmed it down later.

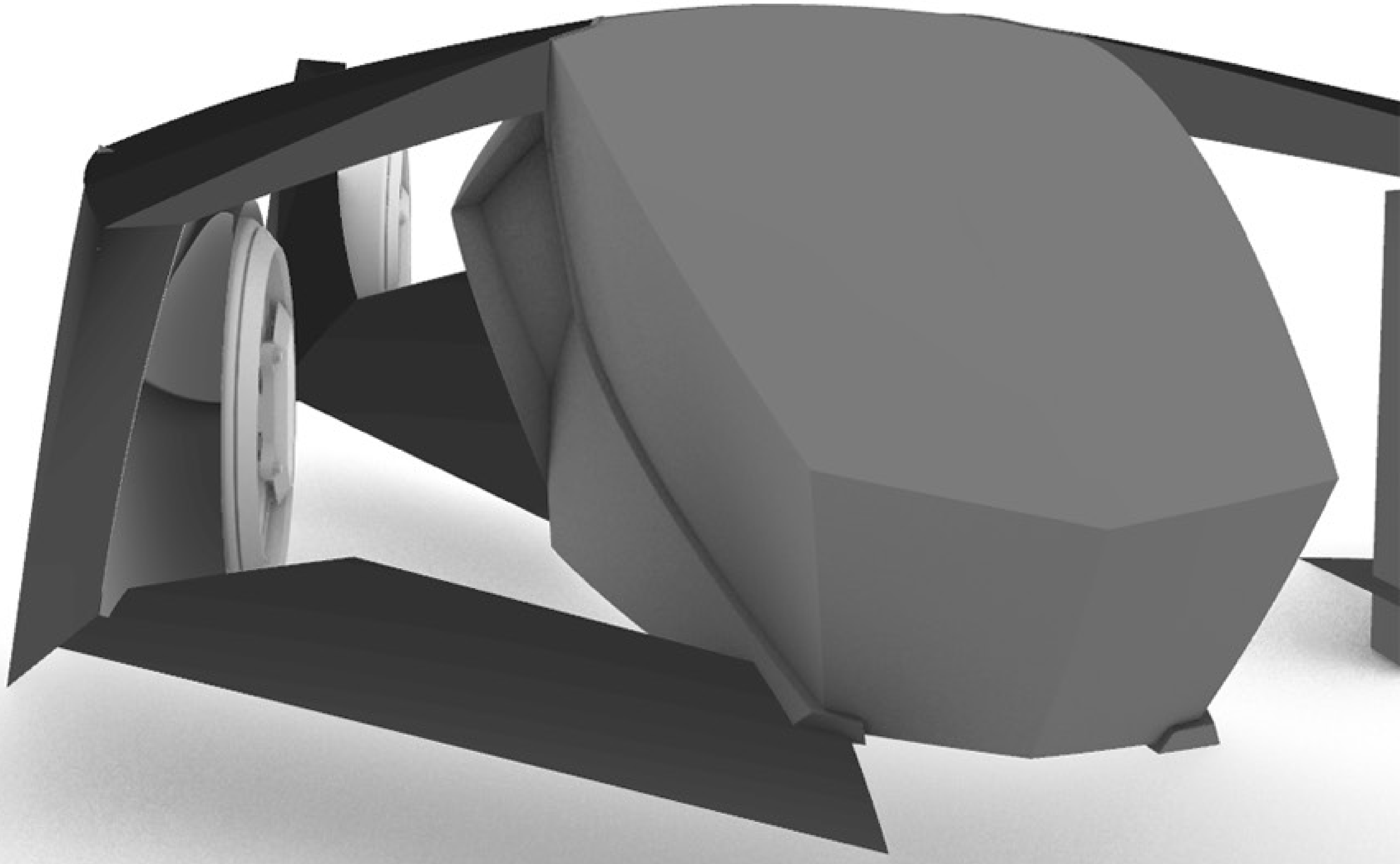
Lower wishbones

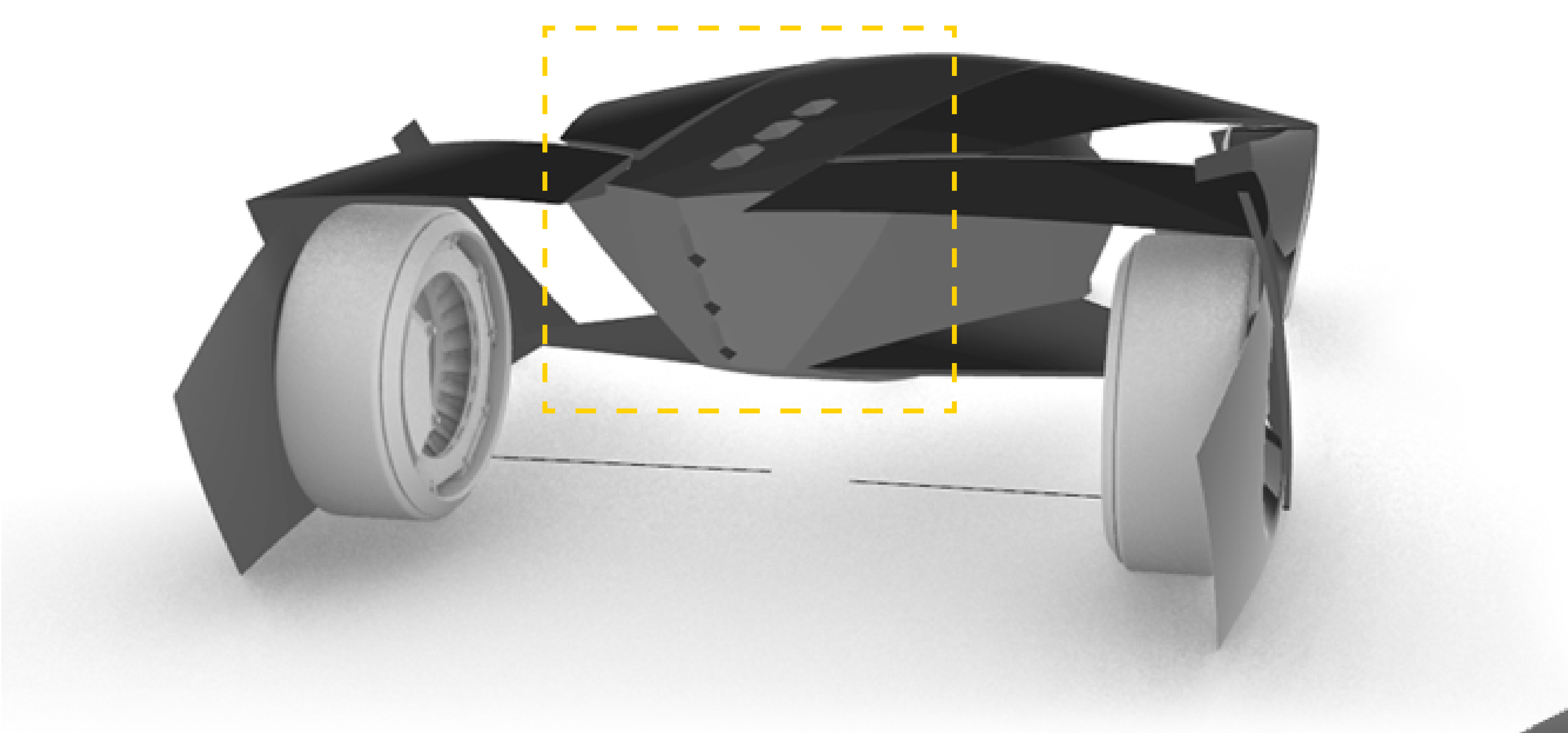
Here I made a big decision to change the front wings into lower wishbones. This solution makes suspension design mechanically much smarter and makes the styling more solid.



Backend is heavily tapered for better aerodynamics

I finished rest of the monocoque with air intakes for cooling.

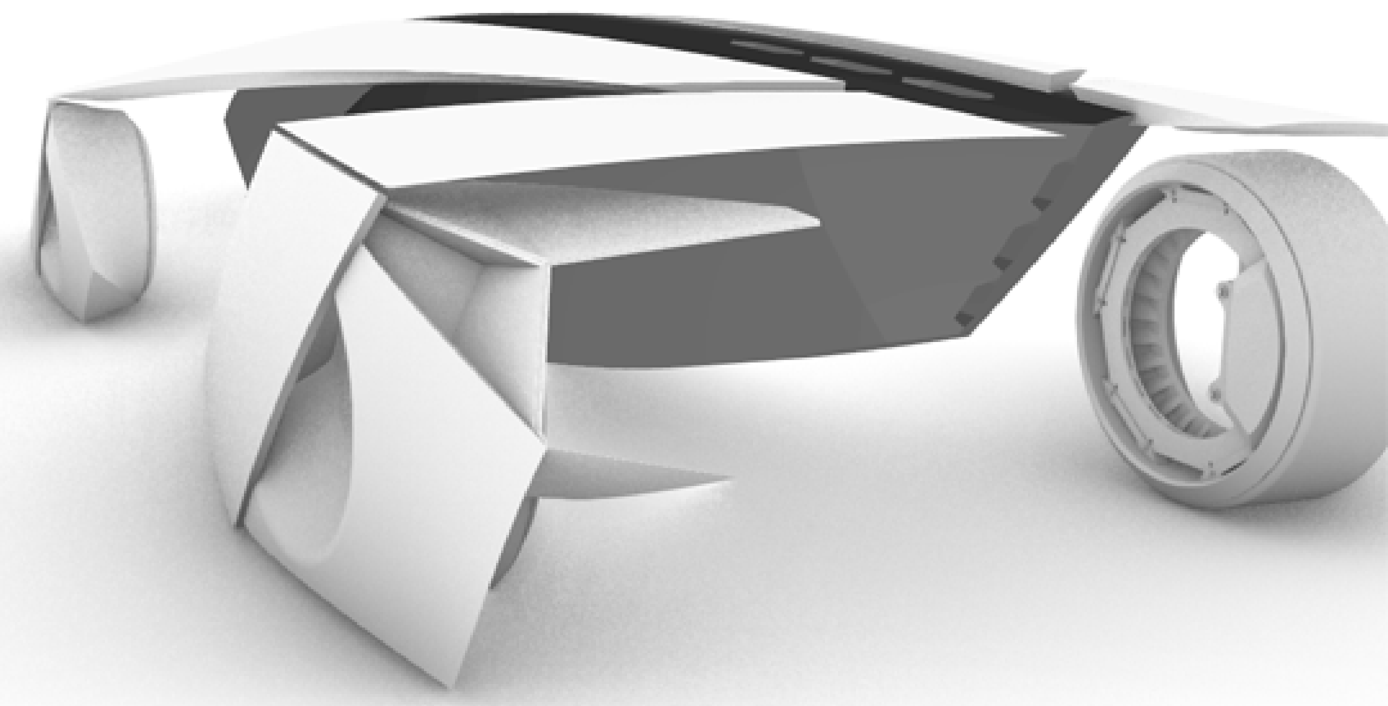


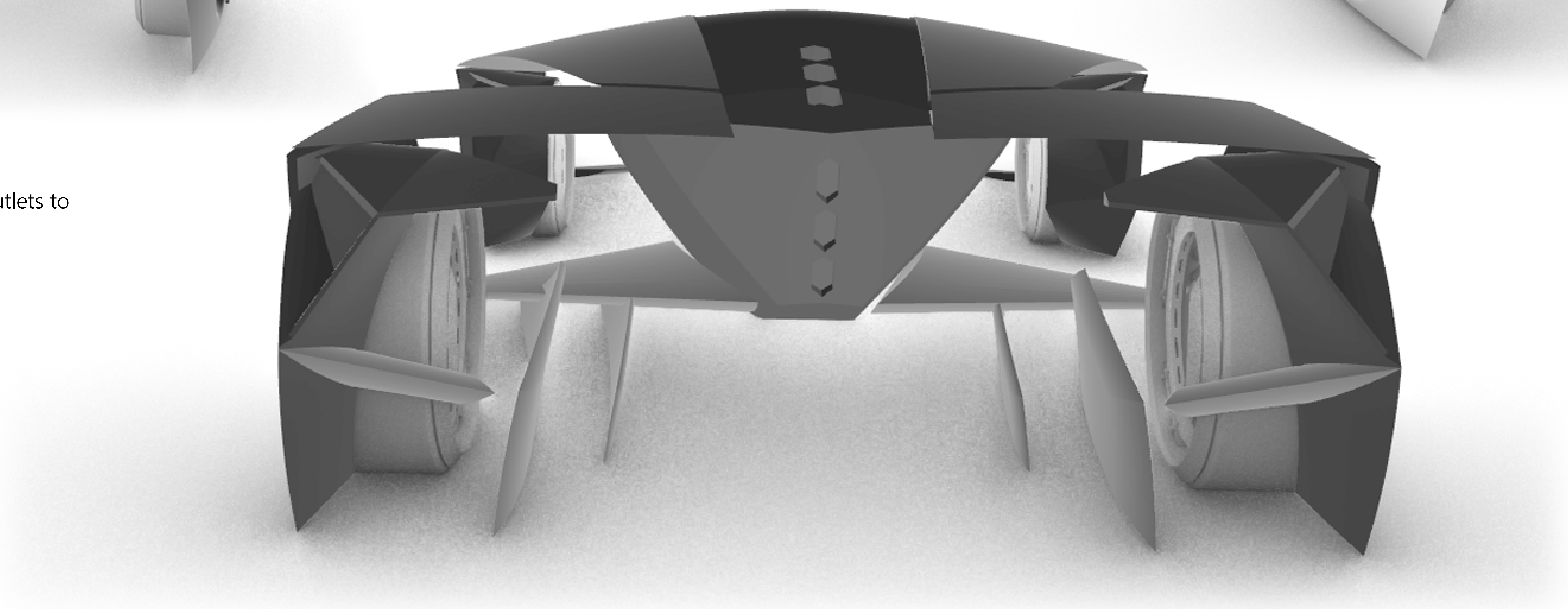


I added quite smplistic cooling outlets to the back of the car.

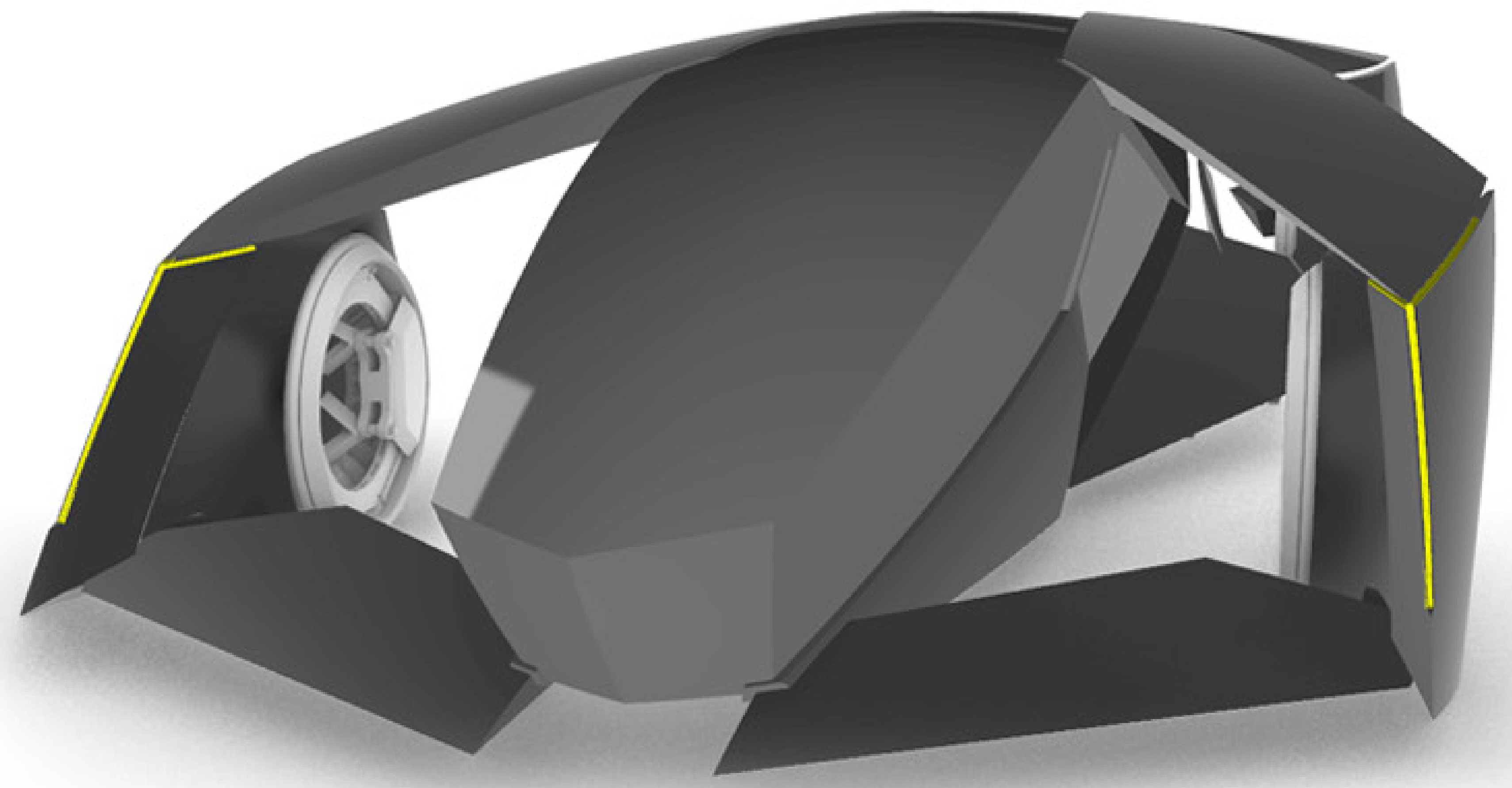
Diffuser

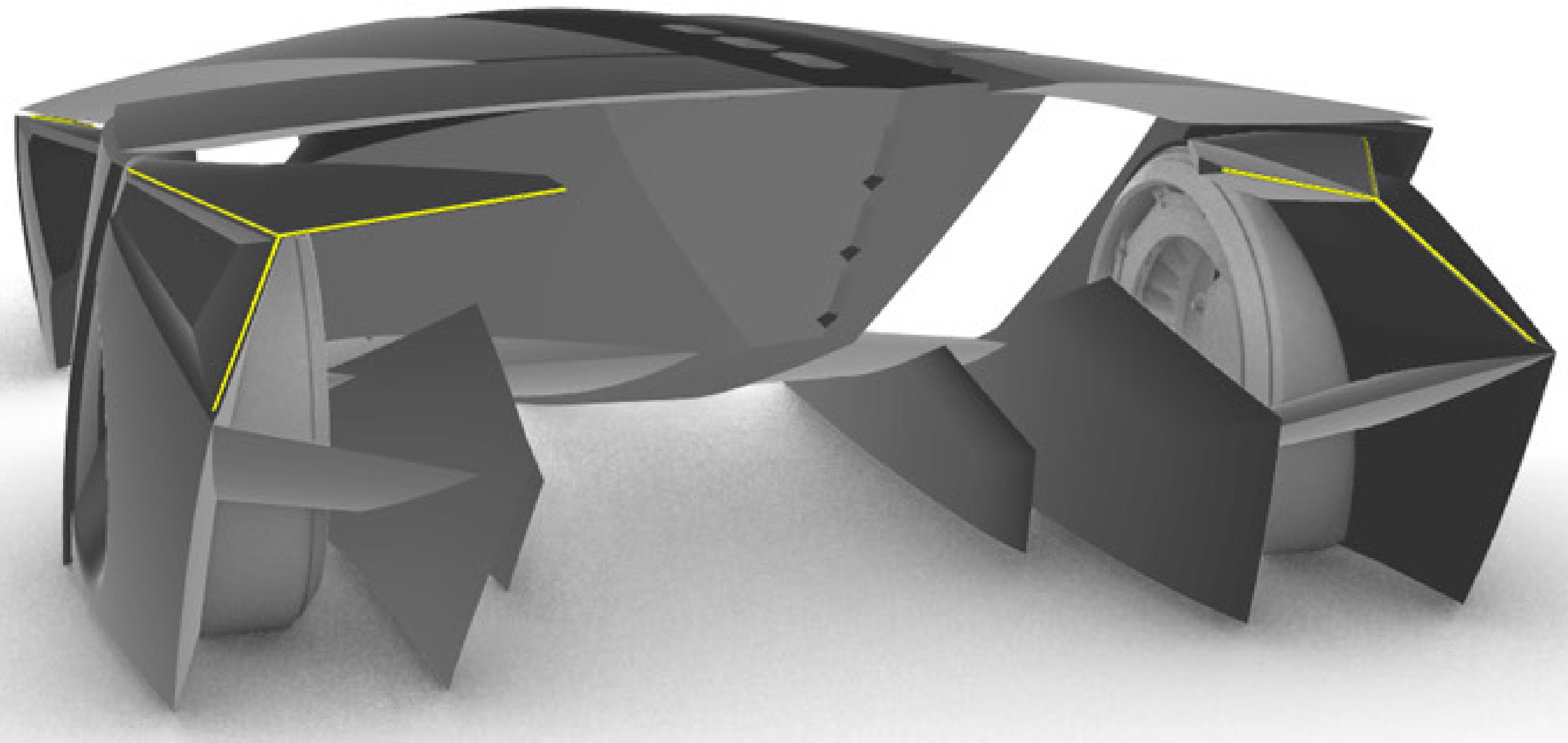
With the rear of the car I wanted to use all the advantages of available space between the tyres. Now there is a lot of room for air to pass through the bodywork and create downforce. The diffuser is formed by the lower wishbones only.

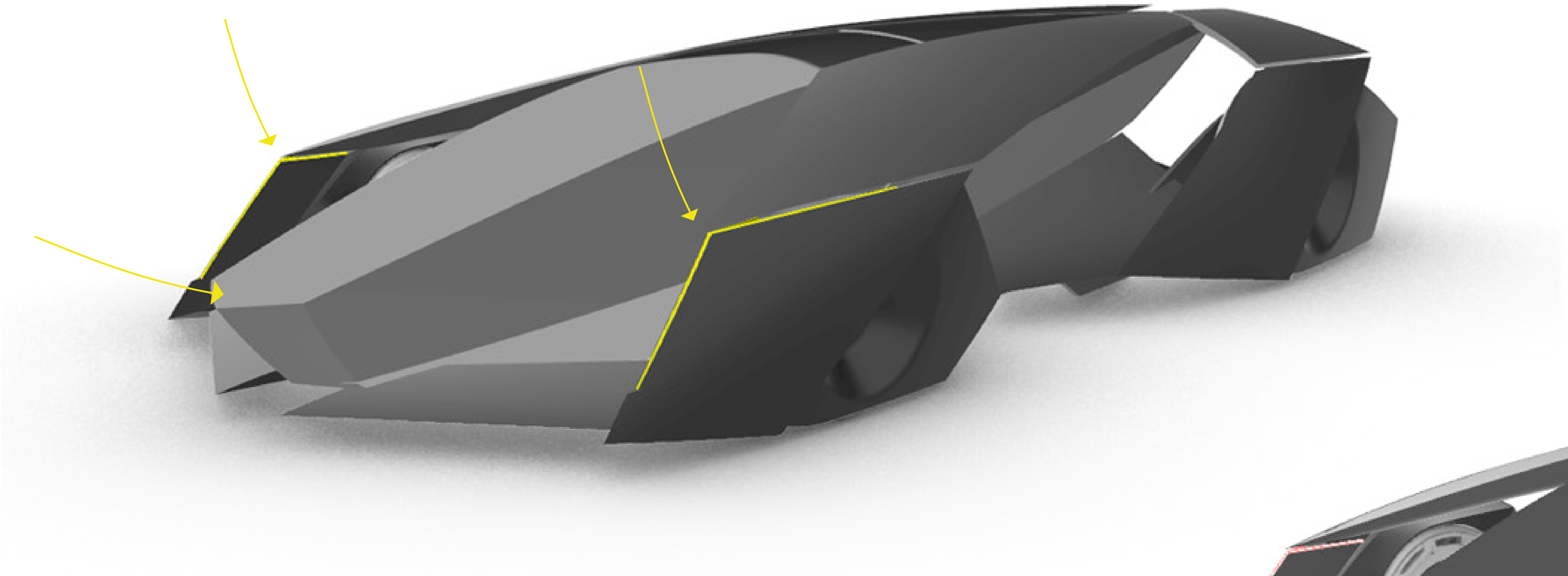




I placed the headlights into the shut line between the upper wishbone and the wheel hub assembly for cleaner design. Each one of the tail lights and headlights form a Y-shape which has been a common theme with latest Lamborghini models.







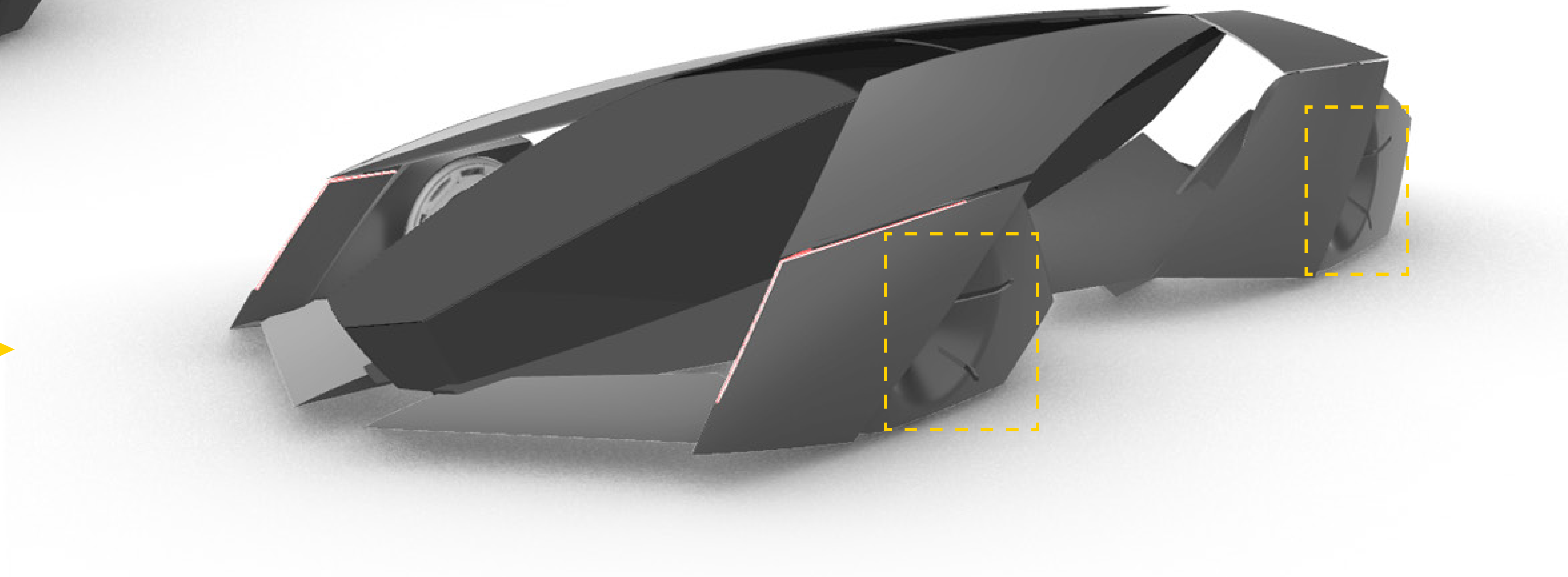
Lower nose

Some small adjustments had to be done here. The canopy seemed a little too long for my taste and the front upper wishbones were a bit too perky. I reshaped the nose and wishbones slightly to correct it. The difference is very subtle but little adjustments like this will have an impact with overall look of the car.

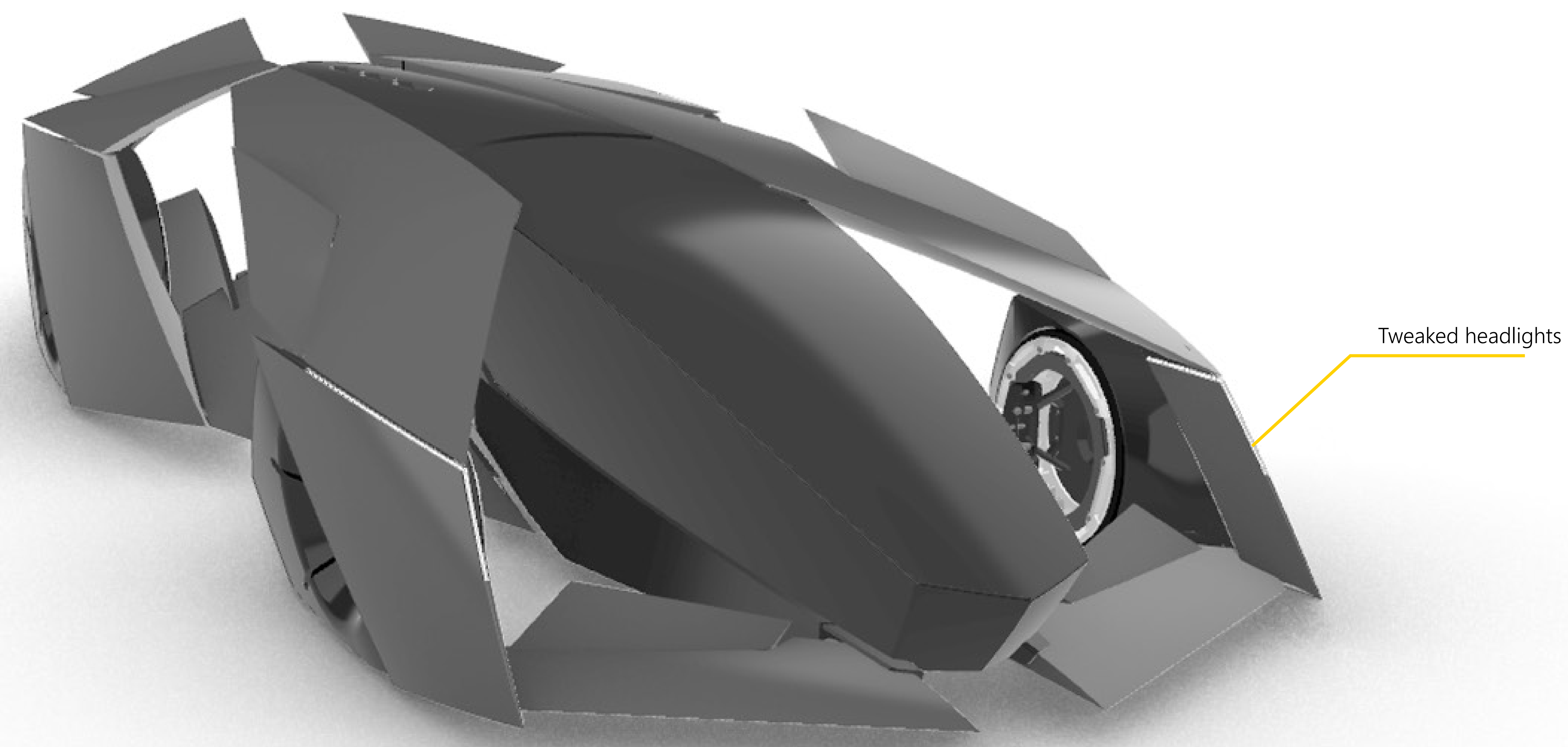
Wheel details

When all the big parts looked good, I started adding more details.

I noticed how weird a car can look if you don't see the wheels so I decided to add little vents to accentuate the wheel shape a bit more.



5.6 AEROFOILS



I cut out the moving aerofoils from the bodywork and then tested how they would look when fully deployed. I tried to place them in such way that they would disturb each others airflow as little as possible.

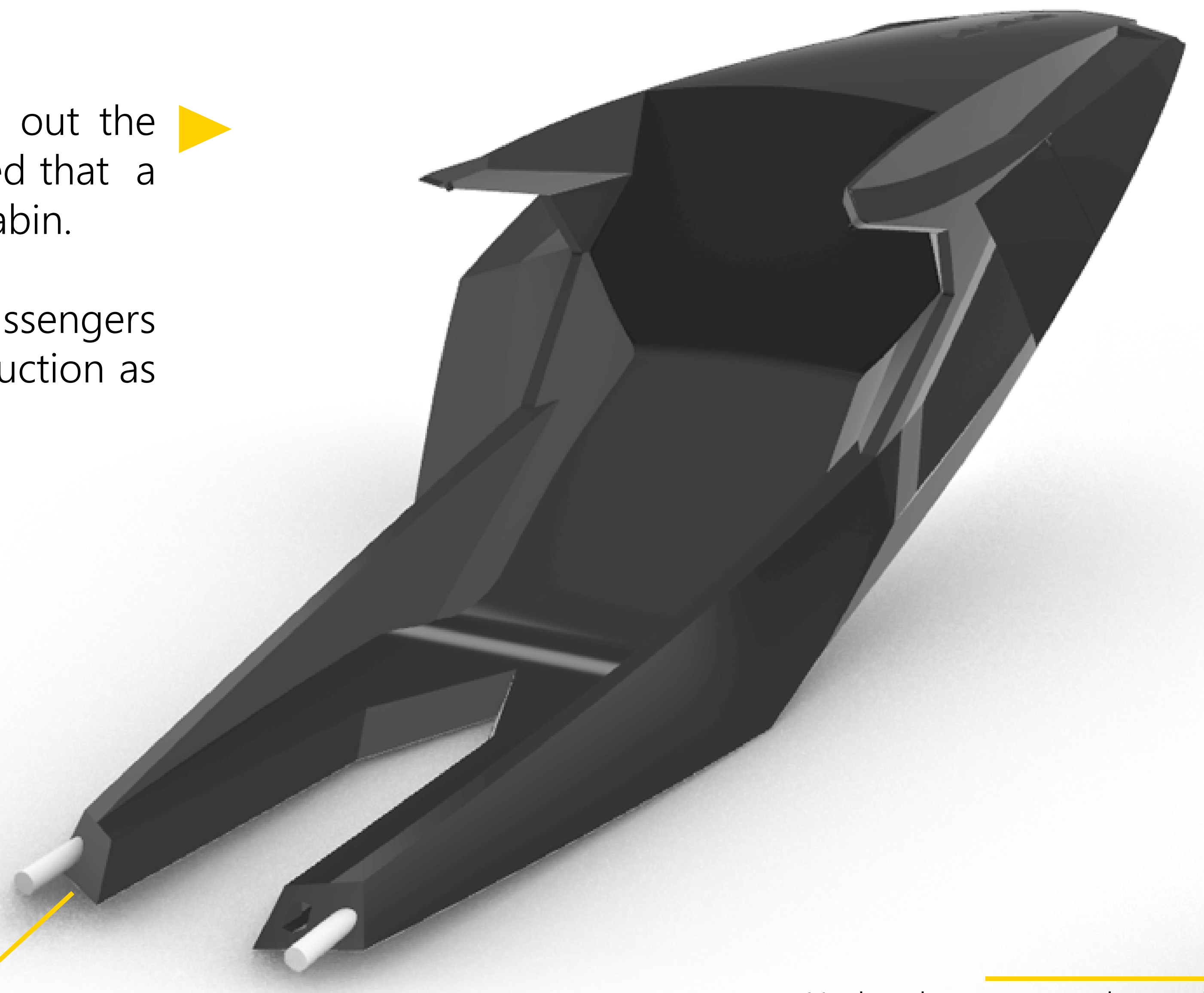
The car looks much more aggressive when the wings are up, but when they are flat, the look is classy and clean. Also the seams give some nice detail to the big clean surfaces.

5.7 INTERIOR

Cabin

I started modelling the interior by carving out the monocoque into a desired shape. I measured that a ergonomically correct seat would fit in the cabin.

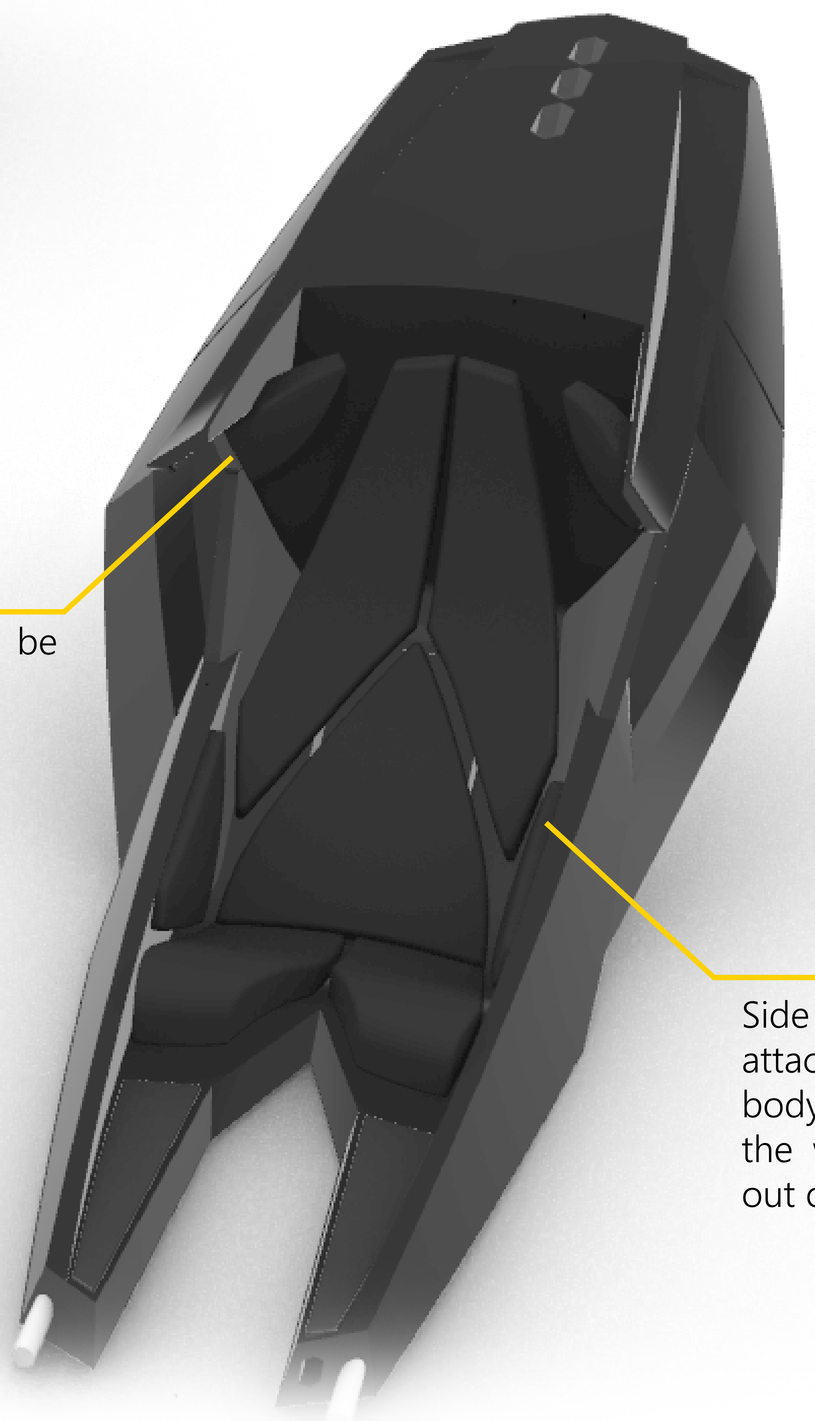
I reshaped the windows based on the passengers line of sight. I wanted to have as little obstruction as possible to achieve the luge-like view



Attachment points for canopys openig mechanism and lower front wishbone

Seat design

For the seat I had inspiration from the dominant shape formed by the upper wishbones. I spent a long time refining and looking for the good looking bodyhugging shape.



He head support pads can be fitted with speakers

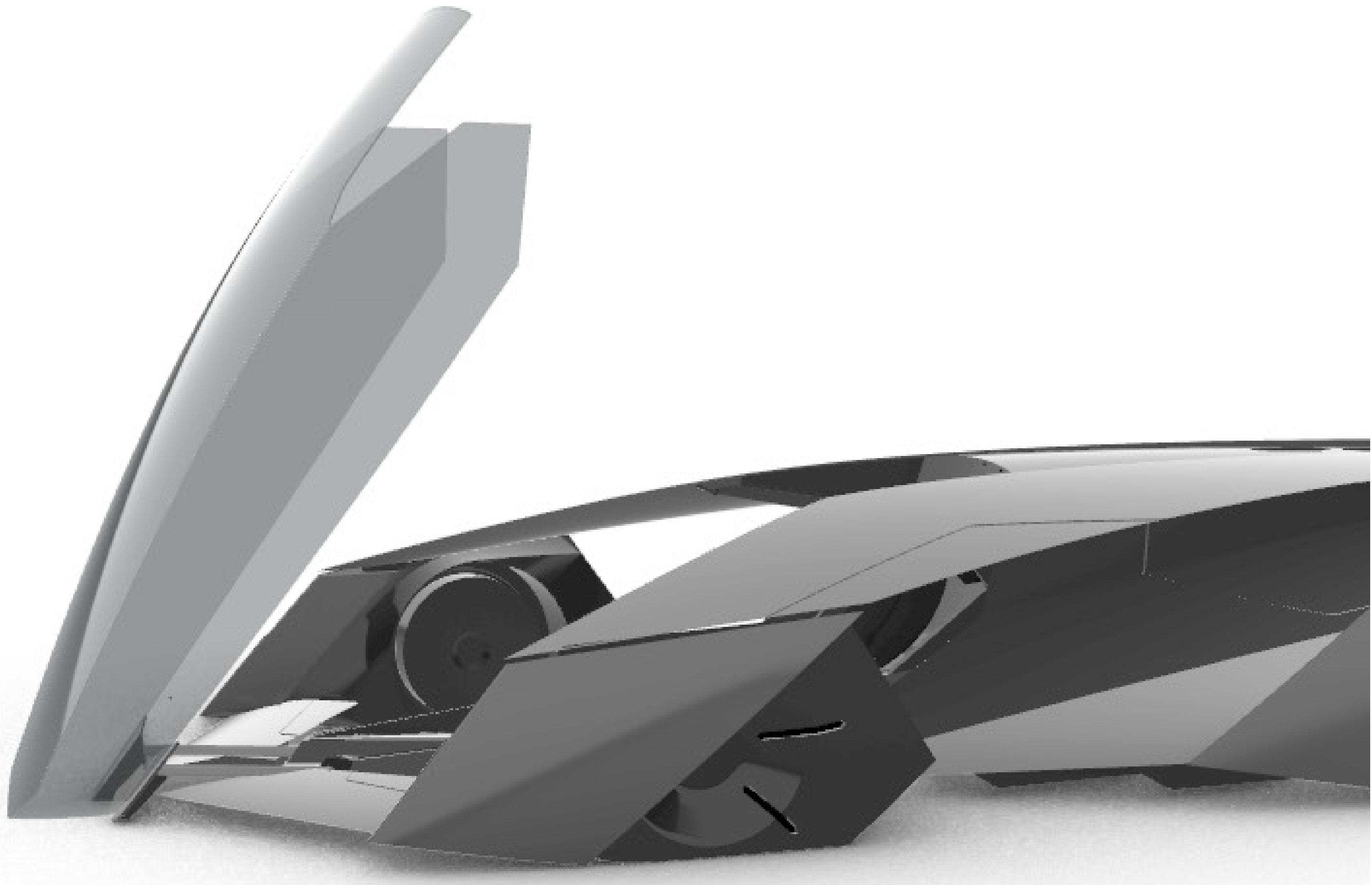
Side support padding is attached straight to the bodywork so they are not on the way when getting in and out of the car.

5.7 INTERIOR

Seat lifting mechanism

I tested different solutions where the seat was rotating on a single pivot point at the front. It was simple but really cumbersome. I ended up with something more sophisticated.

The lifting arms are at the back hidden from view and they make a bit more interesting trajectory than just a single pivot point.

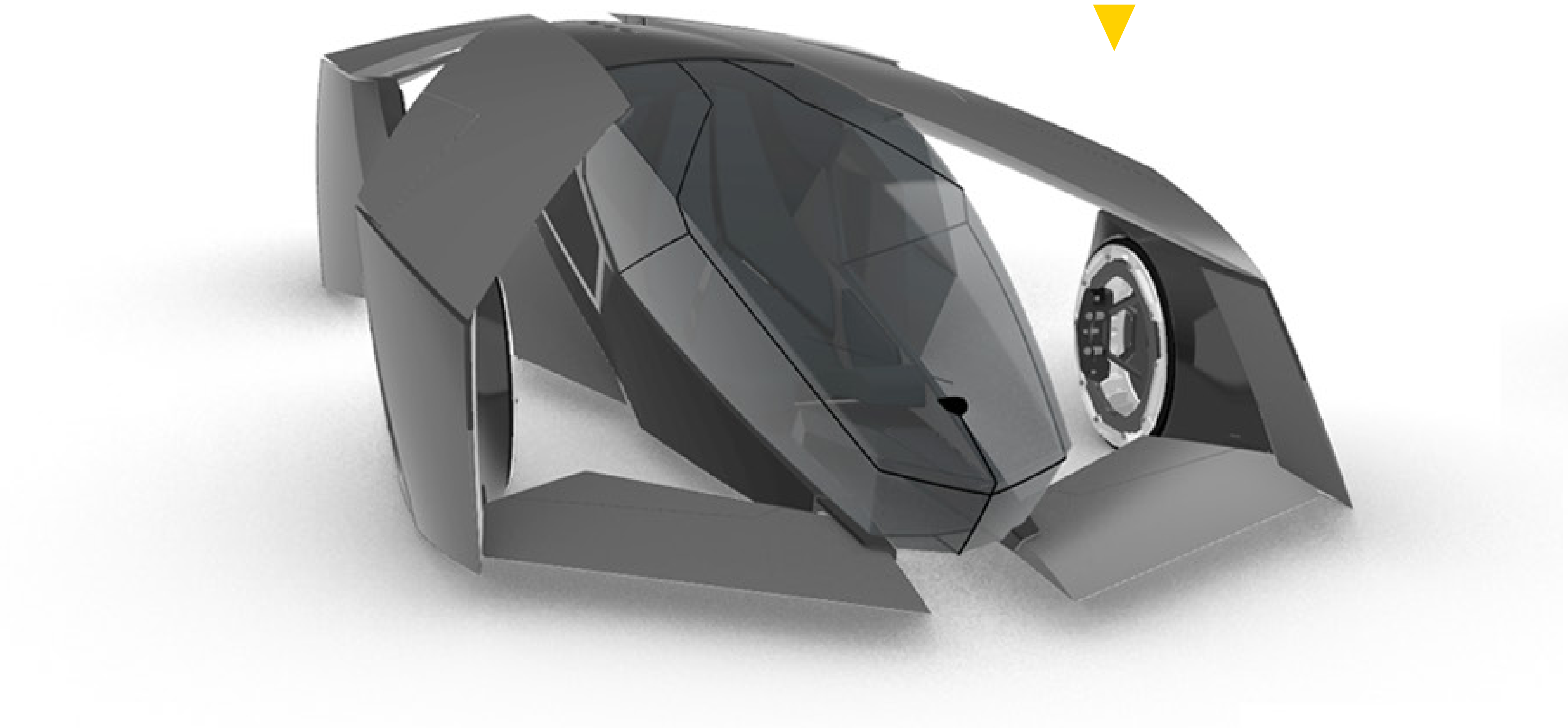


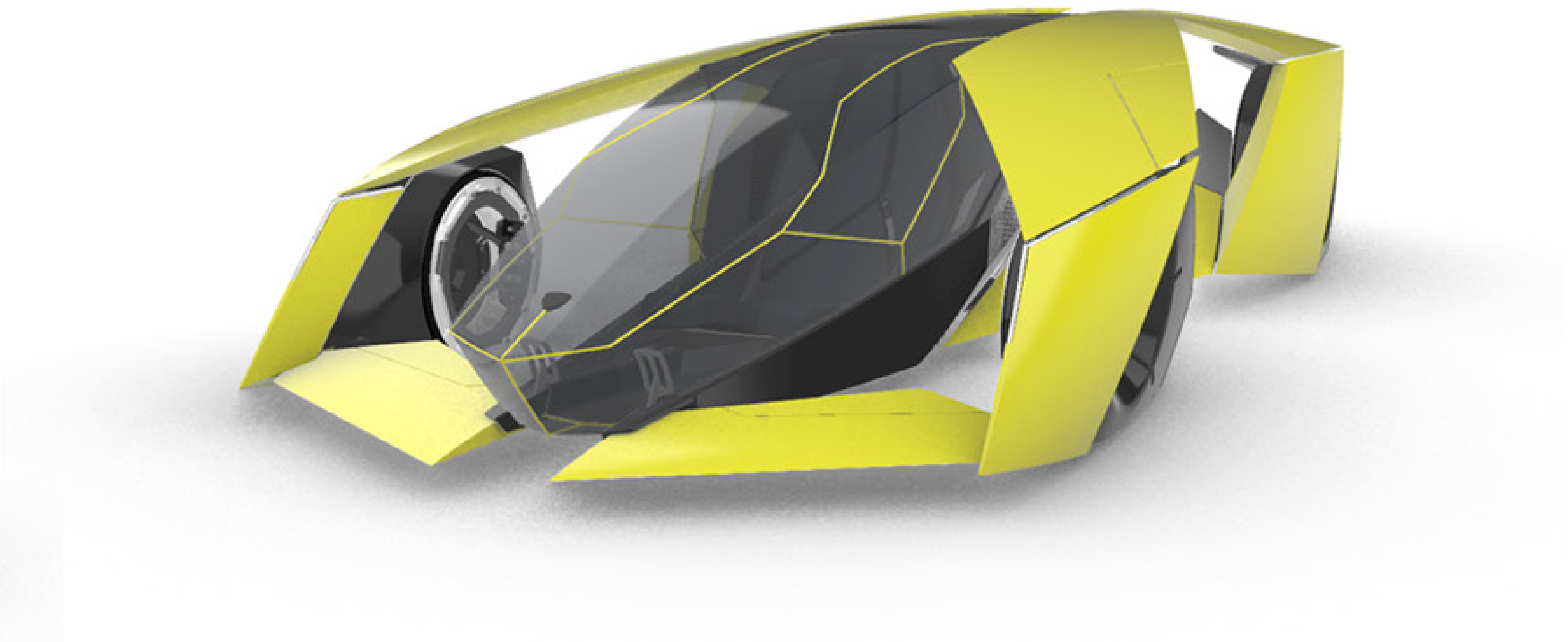
Canopy mechanism

At first I planned that the canopy would have opened to the back over the roof. However, due to the shape it was actually easier to make the glass move forward and up, so that is what I ended up doing. Now it looks a like a little more futuristic version of Lamborghini’s scissor door. Instead of getting in from the front of the car the user will go in between the monocoque and front wheel.

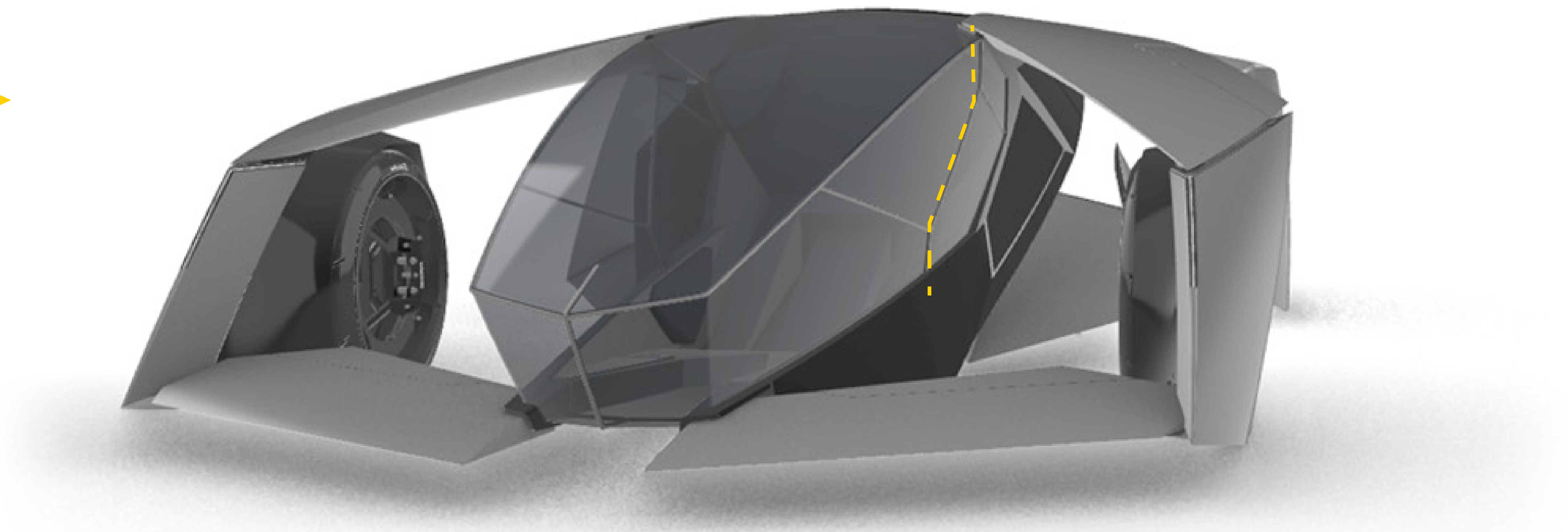
Canopy details

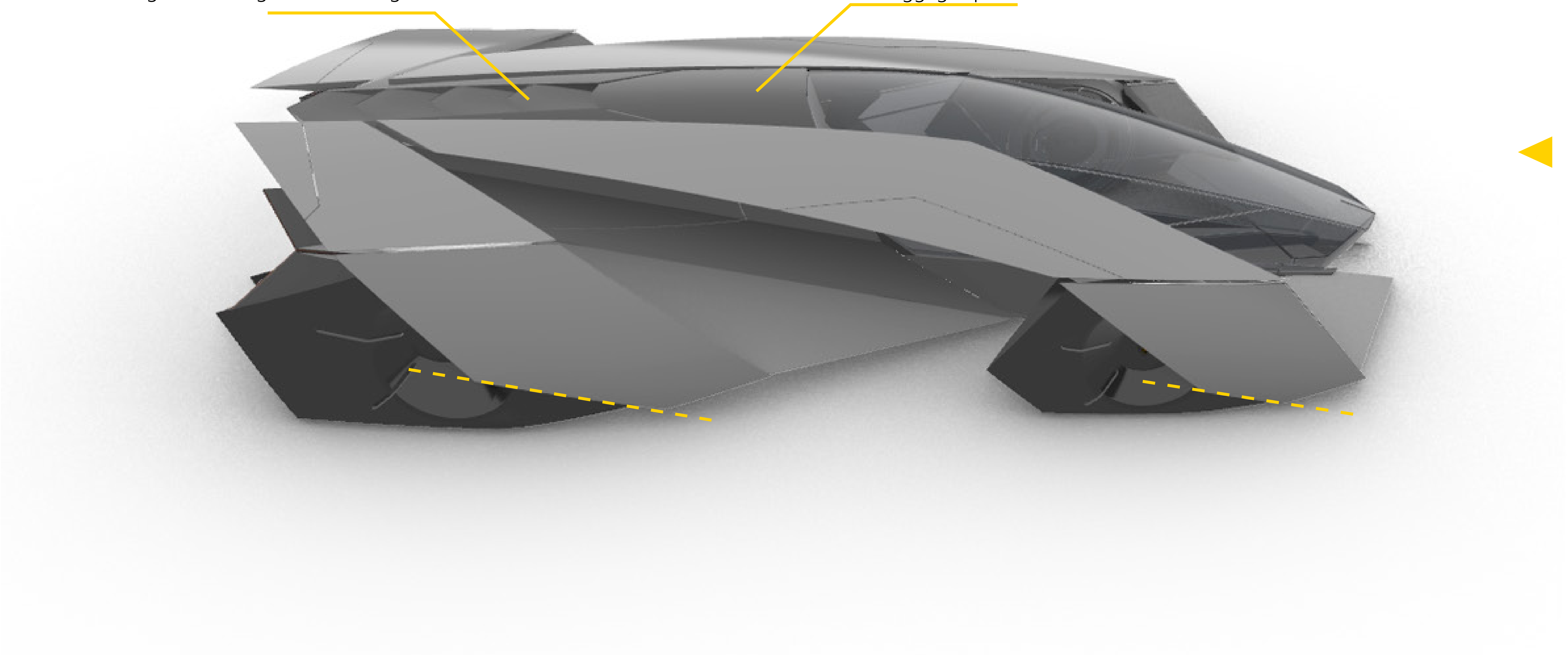
My mentor for this project, Lee Walton, suggested adding some features to the canopy. I tried out few options with different accent colours





In the end I came up with a bit cleaner look. Also I used the added lines to cut a part off the canopy. Now there is less weight for the mechanism to lift up and a bit more space to get in and out.





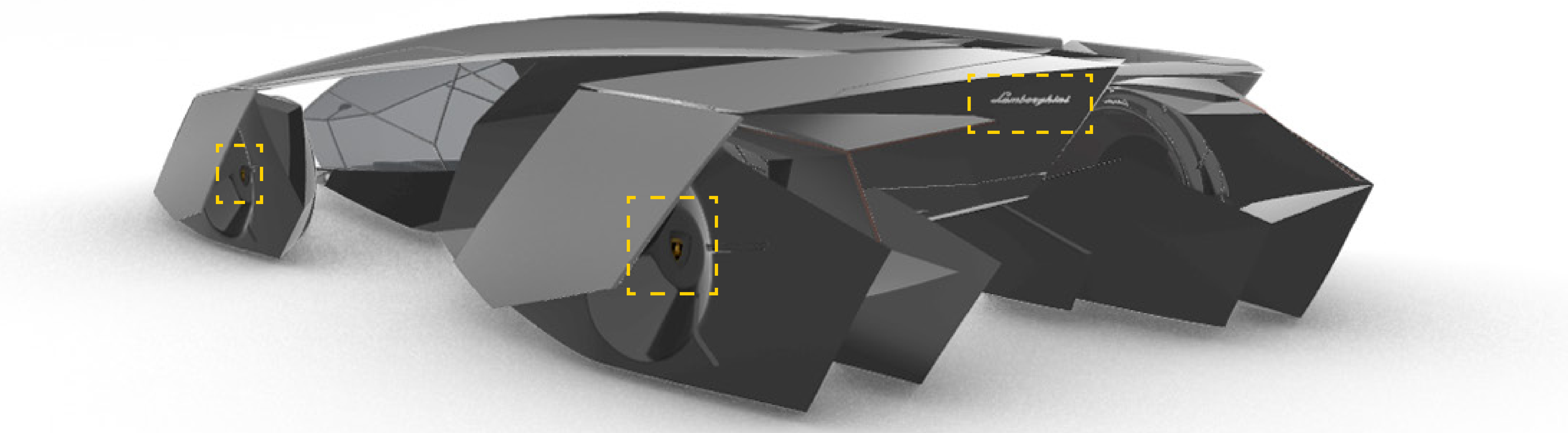
Wheel assembly modifications

Some of the final tweaks were cutting a piece of the wheel hub part. They started to look very weird with big empty surface area. I tried something more drastic ways to make them nicer, but I did not want to brake the basic shape too much so I ended up with this subtle solution which helped little bit with the look. Now there isn't a sharp corner scraping the ground anymore and the wheel shape is more visible.

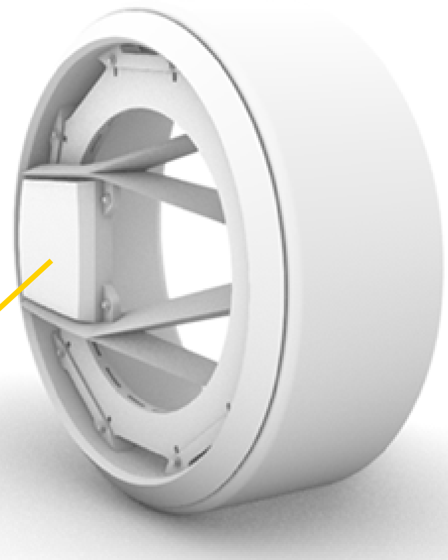
Logos

All the logos were last pieces to be added. After this I tried to add some fillets and just to finalize the model before I would start to make the final renders with VRED.

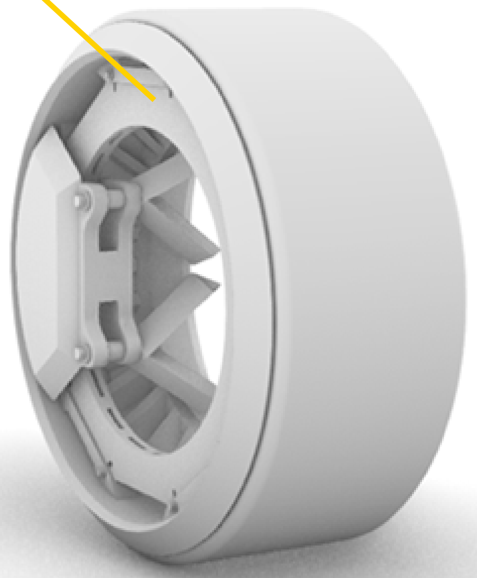
Throughout this modeling process I used to make quick renders from time to time just to see how the car looks in a real environment. This was really valuable because the model looks very different and I could see which parts look good and which still need improving.



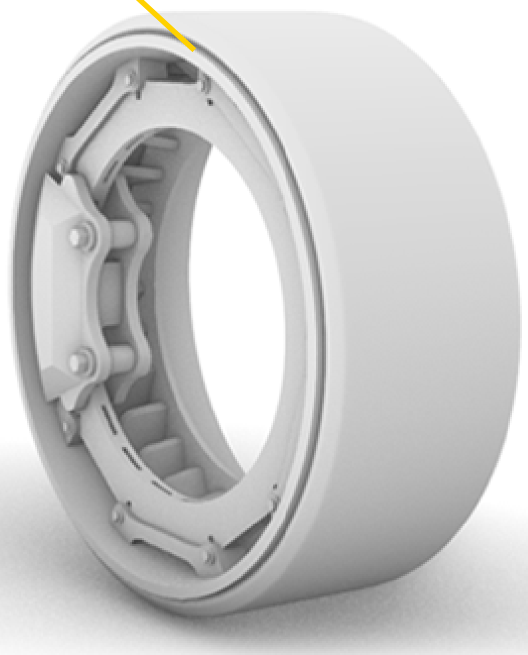
5.9 WHEELS



Just a simple starting point to test out the idea



Little scoops added for cooling



Low profile rim

Final wheel design

I went with a different concept for the final design. The bigger air scoops would resemble a real wheel spokes. They also support the brake disc.

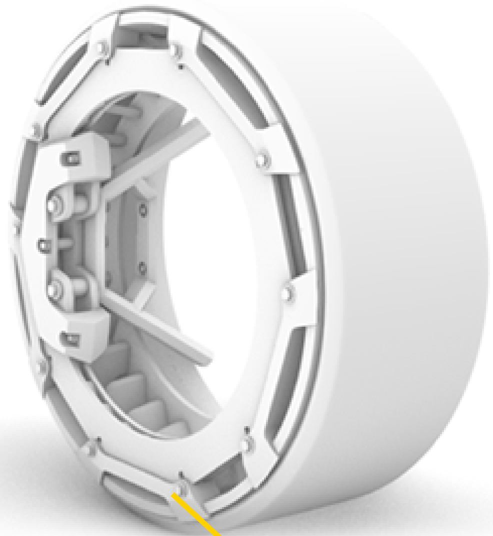
Early versions

For the wheels I tried different versions throughout the modeling phase. I started out with simple ideas and then added more details and realism.

Since the hub motors are air cooled the wheel is designed to scoop right amount of air to pass through.

Because of the motor configuration the brake disc is attached onto the wheel itself. The brake caliper is placed to the inside edge of the brake rim.

Brakes shifted to the very edge. Looks extreme but not very car wheel like.



I made proper looking brake caliper that would end up into the final design.

6

FINAL DESIGN

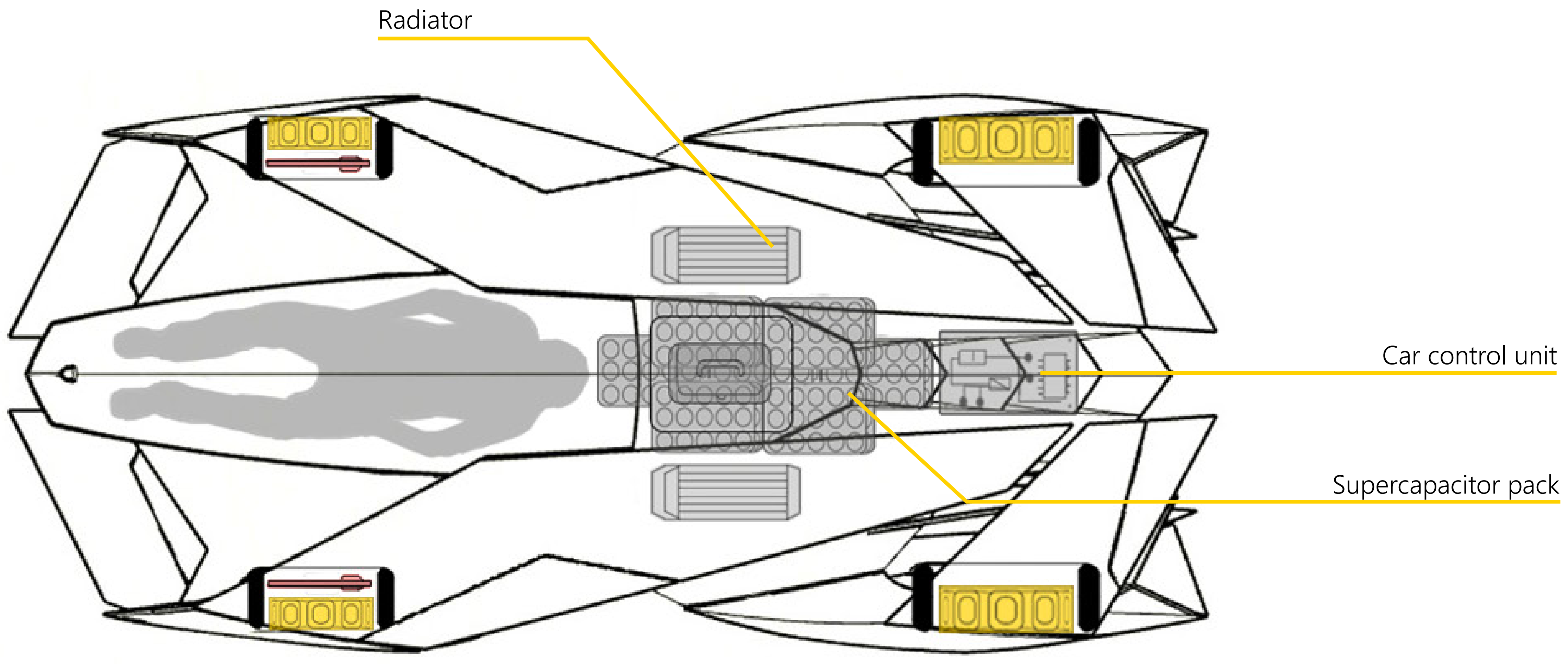
6.1 PACKAGE DRAWING

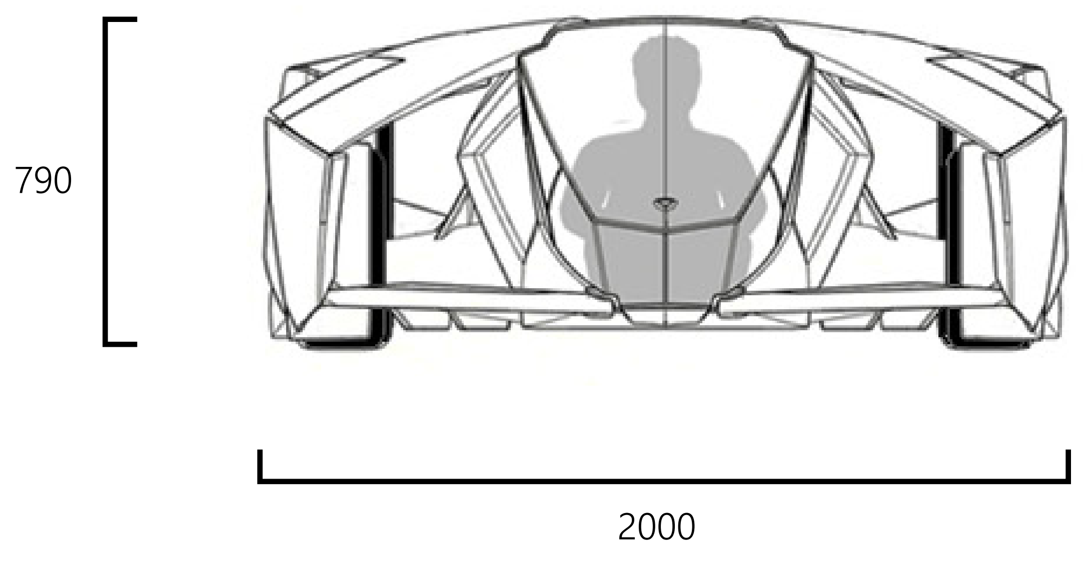
Here are basic dimensions of the car. Since It is very hard to predict how much space each part of the future technology will actually take, I did just a rough estimation of where everything is located. I did not dream up any specific performance figures either, but I think the 1 kilogram per 1 horsepower mark should be achieved.

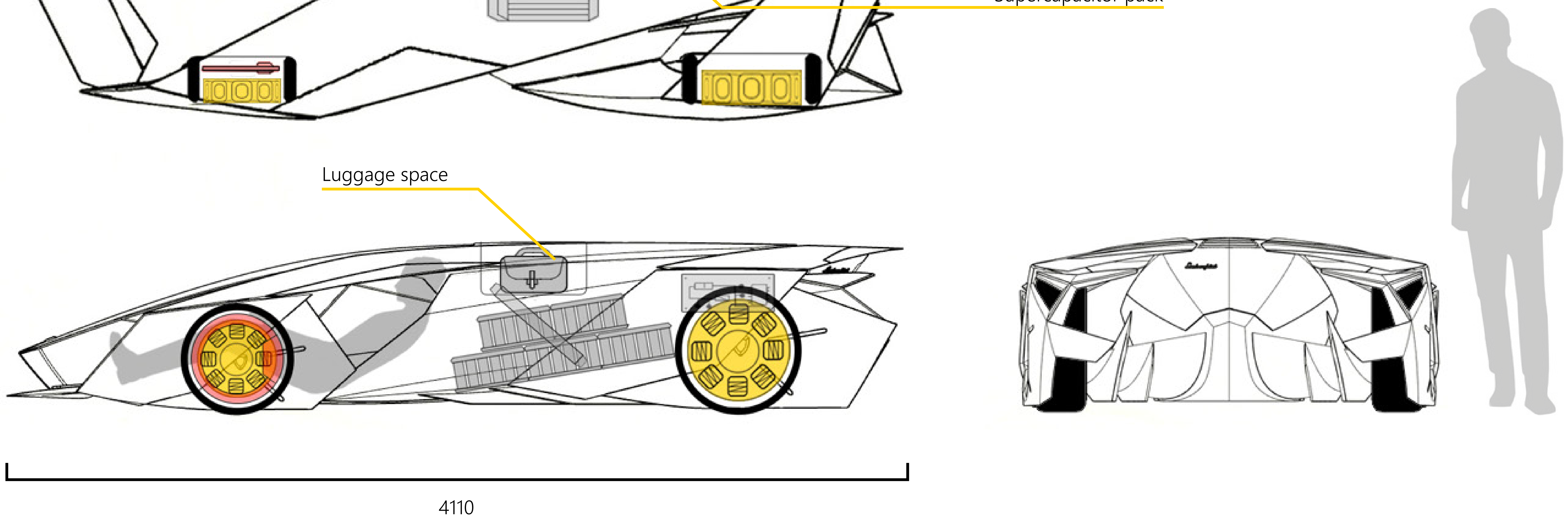
Hub motors

There is a motor for each wheel. Rear wheels are slightly bigger to accommodate bigger more powerful motors. This moves the power balance more to the rear for better handling characteristics.

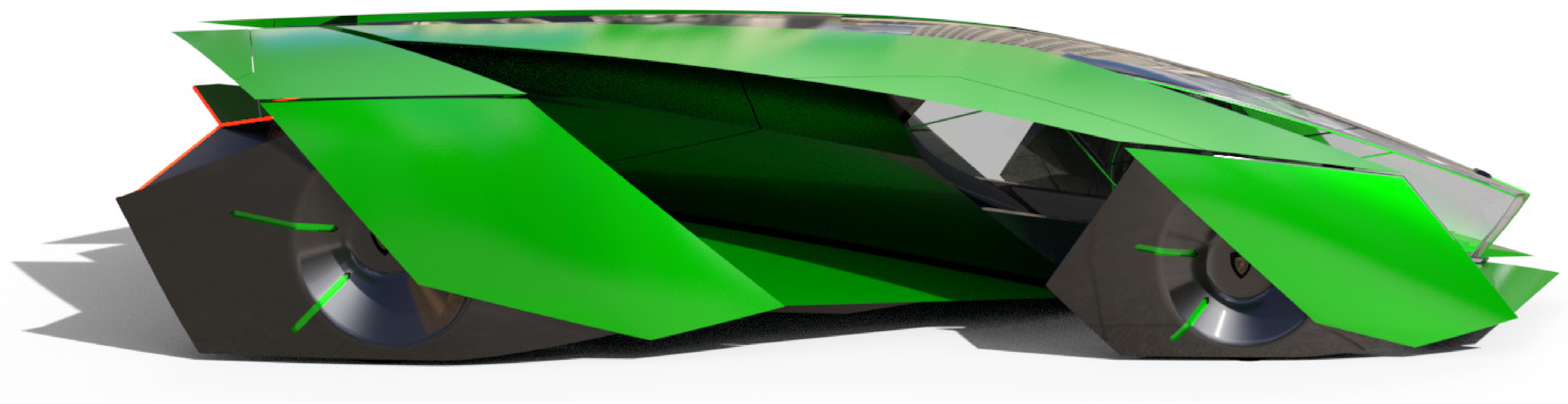
The motors regenerate as much energy from braking as they can. With the bigger motors alone there is enough braking power at the back. The front tyres which need more braking power are aided with disc brakes.

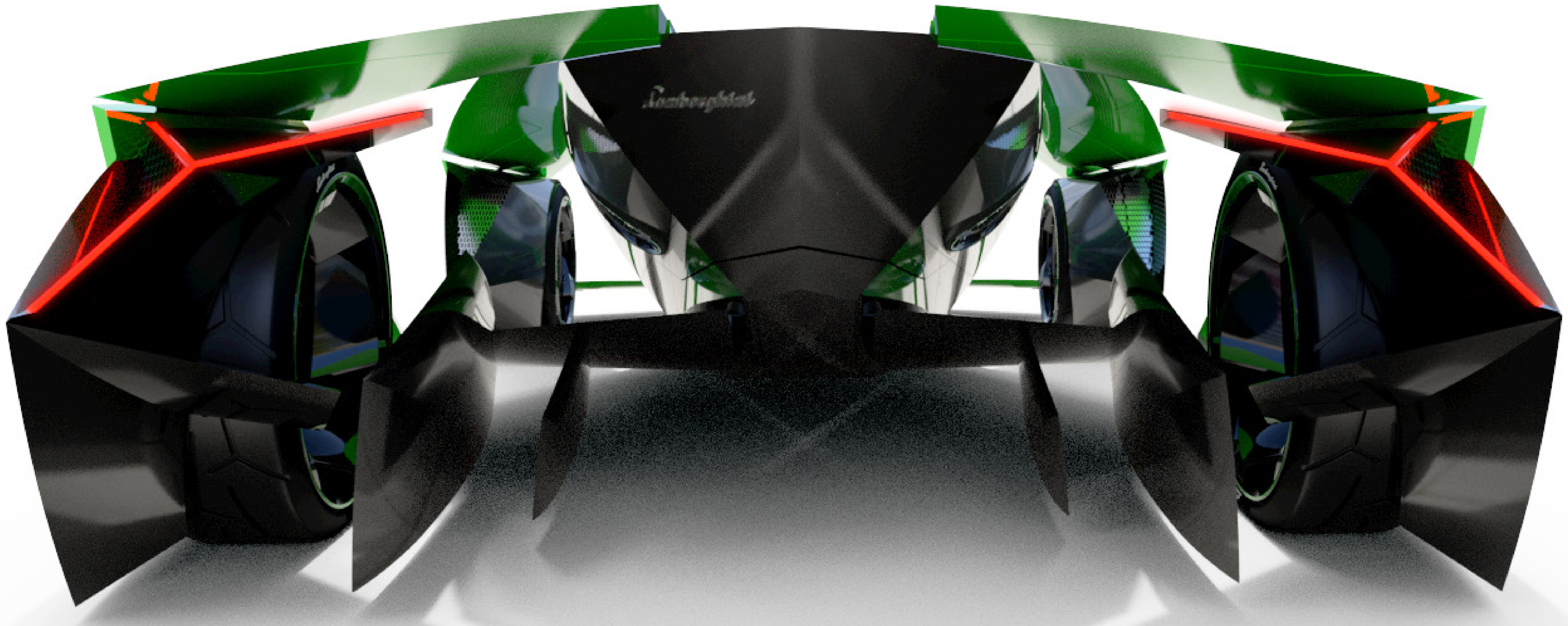






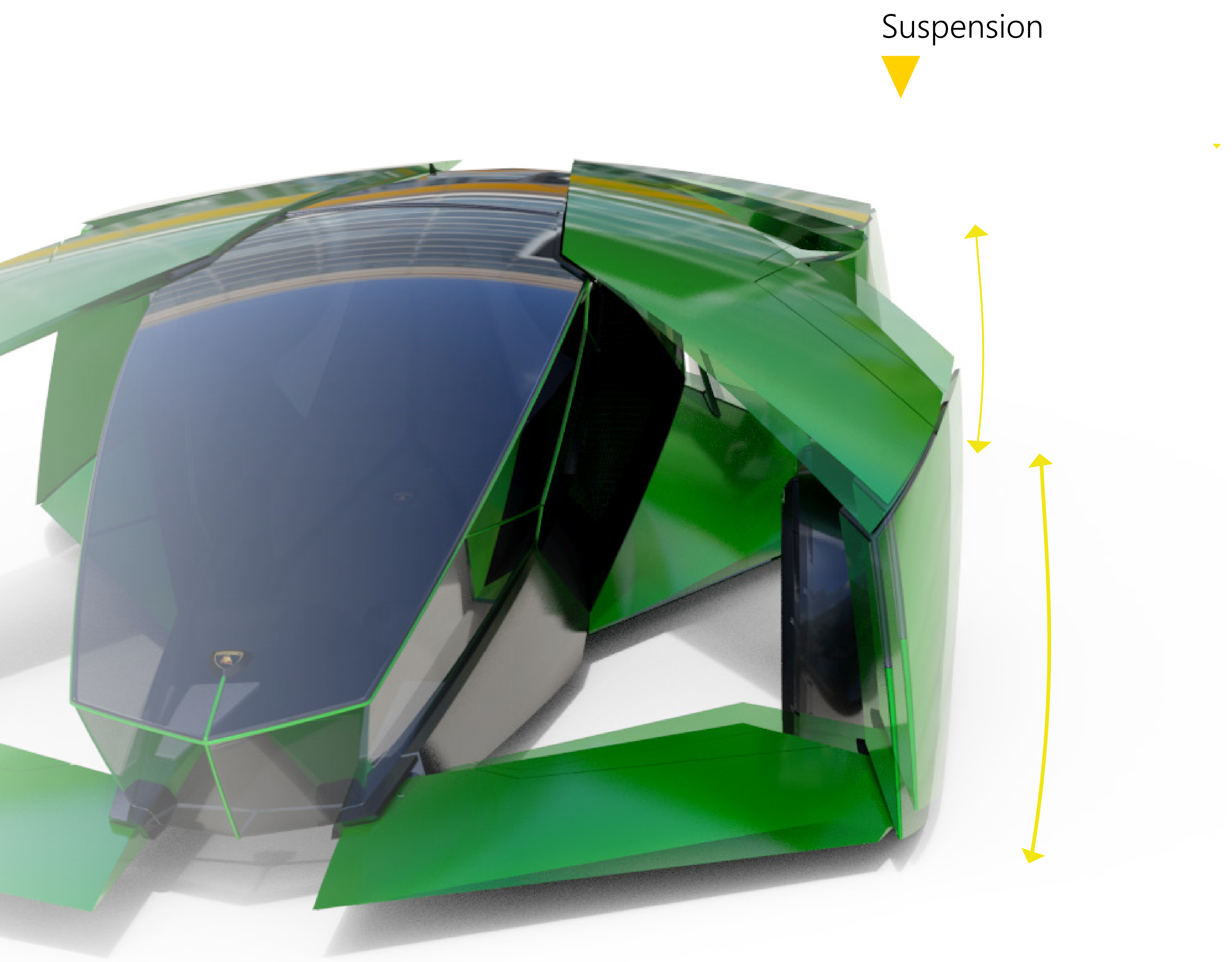
6.2 FEATURES

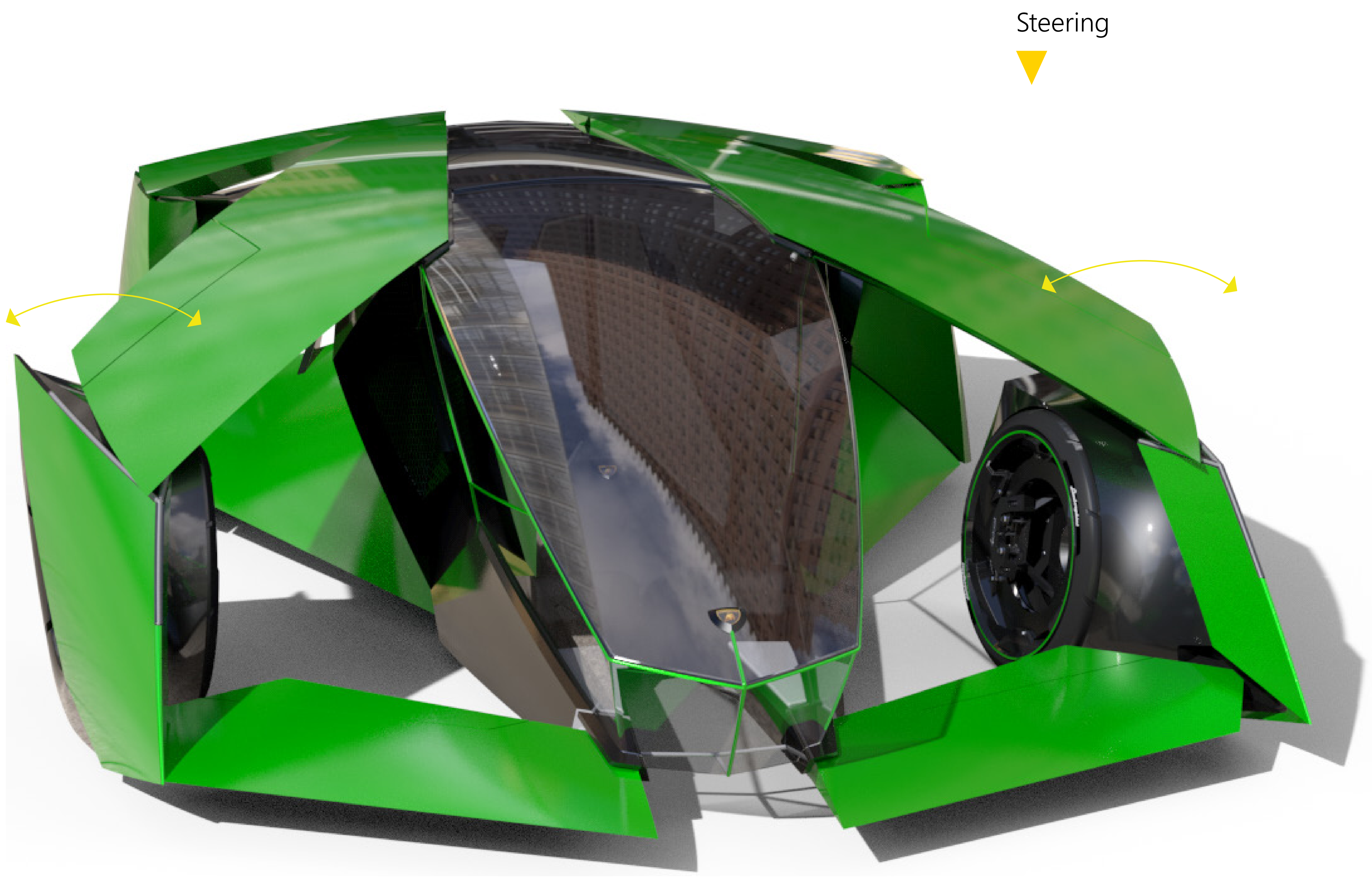


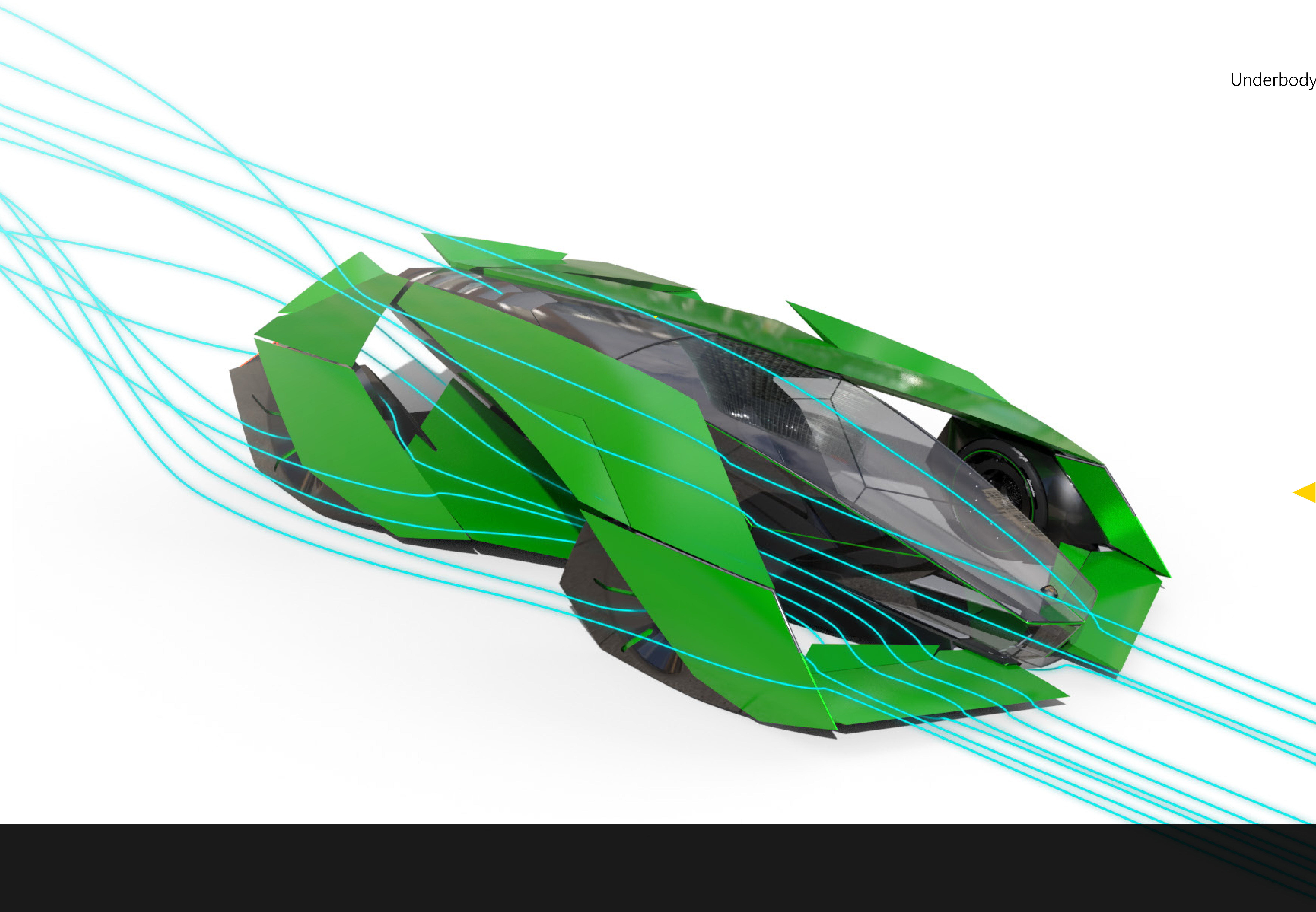


Driving modes

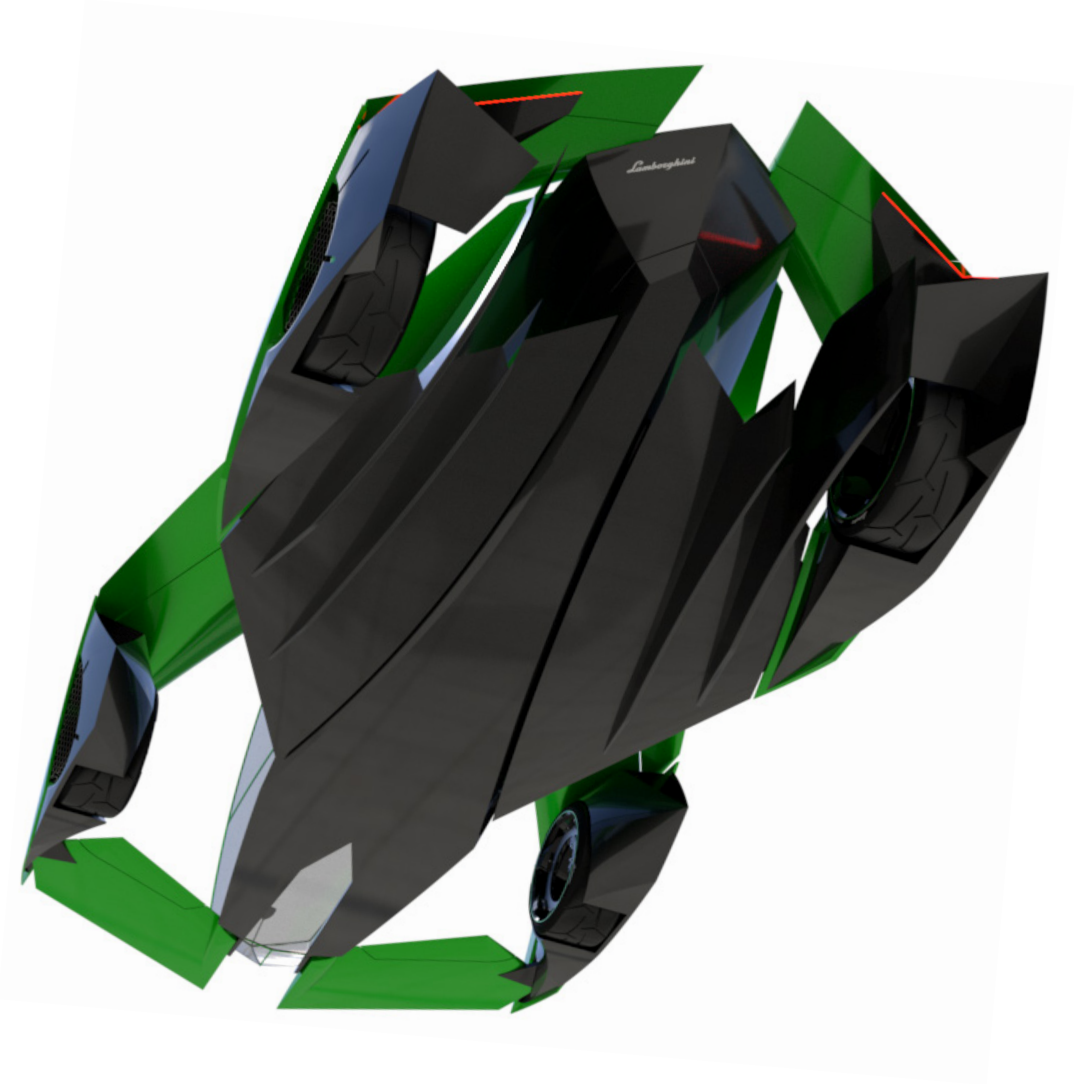
The user can choose what kind of ride he or she wants: Relaxed, aggressive, fast, slow, comfortable... When the car is in heavy traffic like in a city or motorway it drives according to other road users.







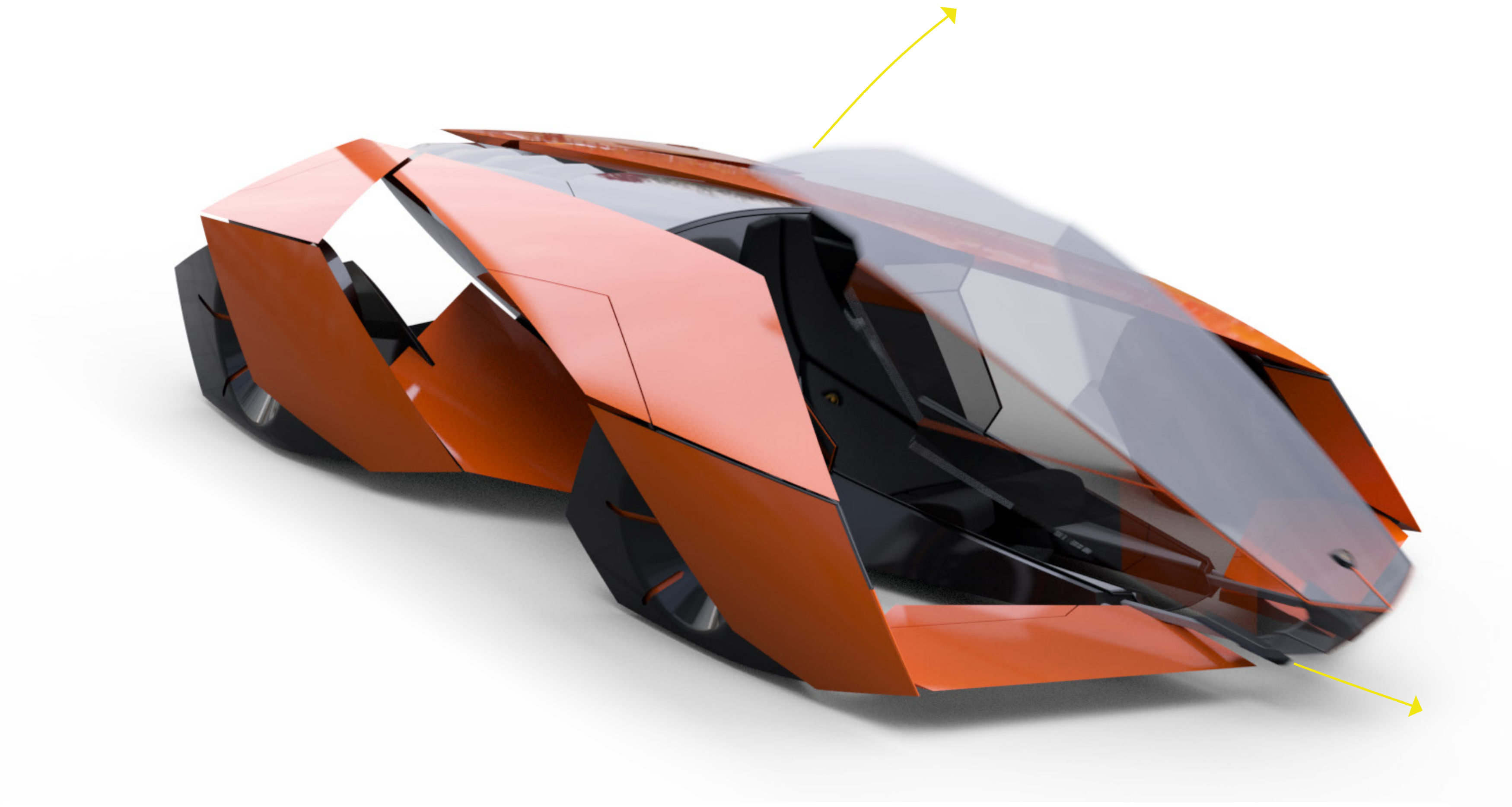
Underbody



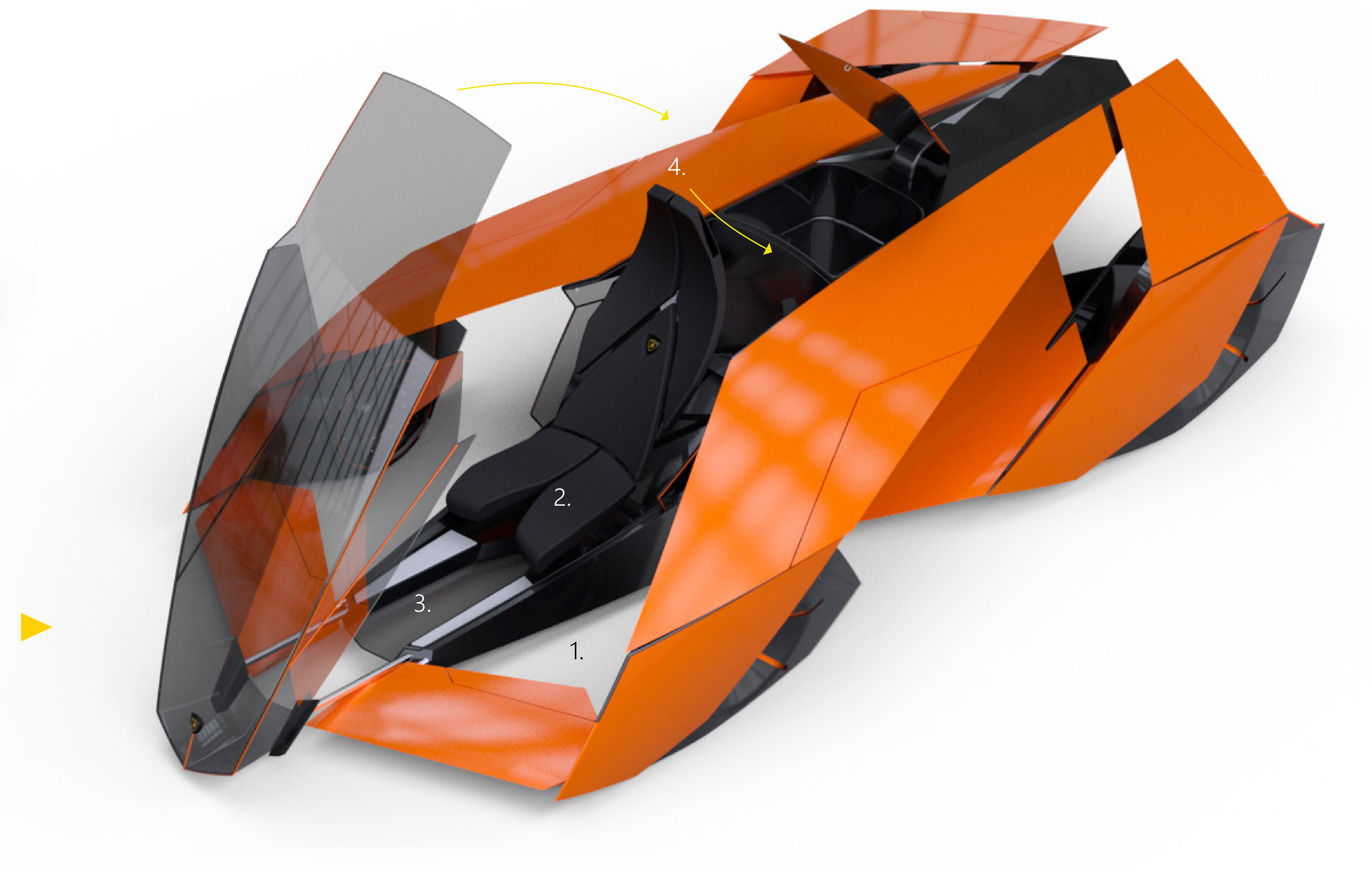
Aerodynamics

All six moving wings are controlled by the car individually. This way the car can control its balance and grip levels according to different driving modes.

Each wishbone acts as an aerofoil to create downforce so the force is directed straight to the wheel. This is more efficient way of producing downforce than a regular chassis mounted wing.



Luggage space is placed as high as possible for lower weight distribution.



Getting in

1. Step into the space between the front wheel and the seat
2. Sit
3. Pull the legs onboard.
4. The car lowers the seat back and closes the canopy as soon as it senses that the user is in place.

6.3 INTERIOR

The interior is very simple and keeps the focus on the ride experience itself. The low sitting position at the front close to the ground brings a sense of speed. The in-turned wheels and exposed wishbones create a new kind of connection between the user and the machine.

The HUD changes depending on the used driving mode. Only the most relevant information is shown for each mode. The whole interface can also be turned off.

An example of a simple HUD of one of the driving modes:

1. Holographic button for a drop down menu
2. Way-point shows the destination
3. Speedometer
4. Intended driving line
5. Power output/power regeneration for each motor

Backround pictures: Versveldpas (Zaal 2017)

6.4 RENDERS

Backround picture: Versveldpas (Zaal 2017)

Background picture : Chapmans Drive (Zaal 2016)

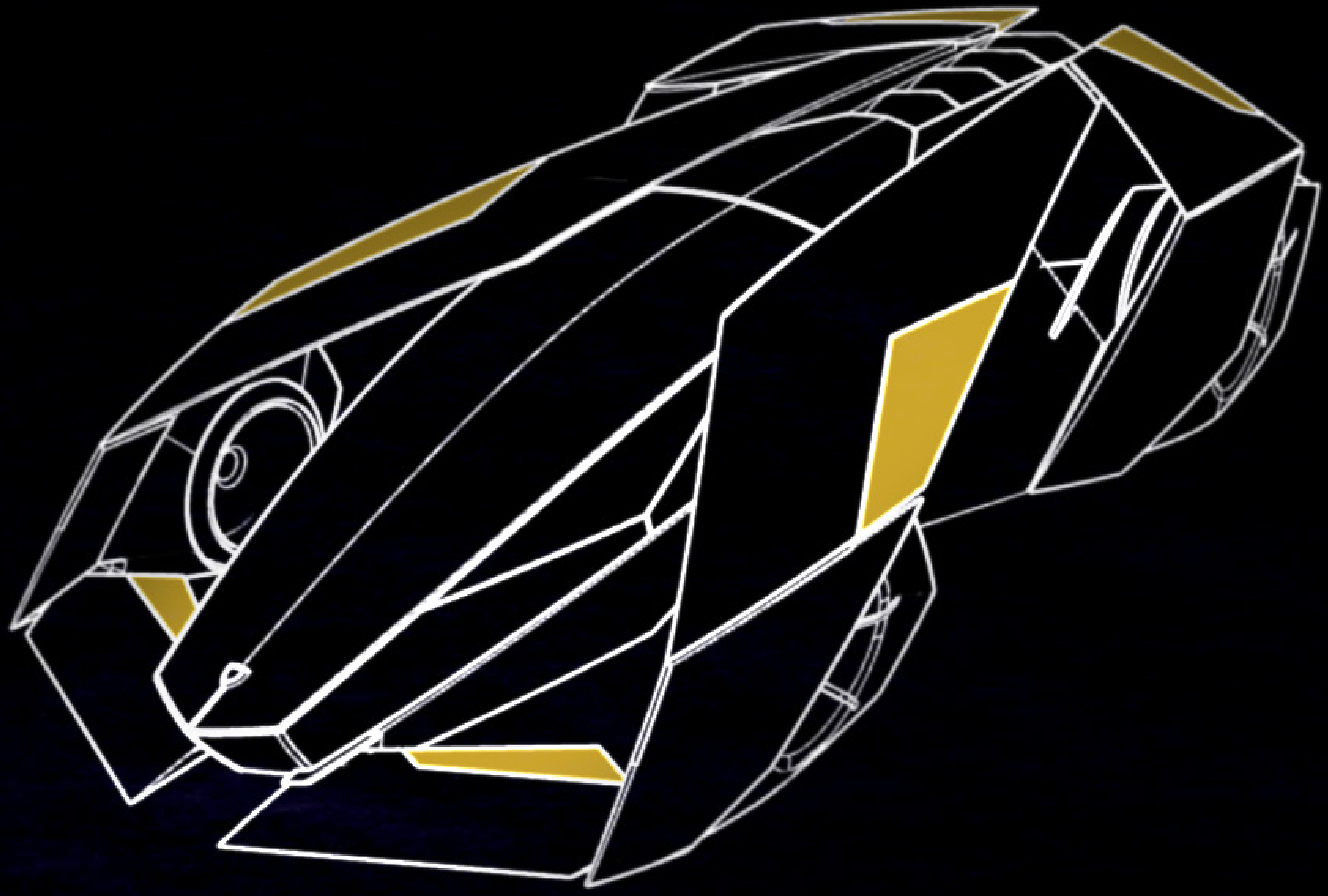
Background picture : Paul Lobe Haus (Zaal 2016)

Background picture : Ostrich Road (Zaal 2016)

Background picture : Ostrich Road (Zaal 2016)

7

EVALUATION



7.1 DESIGN PROCESS

Since the topic was my own It was very interesting to me and I had plenty of work motivation throughout the process.

The research part has never been one of my strengths. I feel that it my research was quite slim with this project as well.

During the modeling phase I still did some sketching occasionally, which helped a lot. I think I should have used sketching more to get more ideas on paper to hurry up the process and get more variation on different styling options.

The modeling phase took huge amount of time. Doing design work on 3D software is not so efficient especially with my chosen software. I did play it safe by choosing a familiar software. However doing the model with Alias for example and learning the software at the same time wouldn't have been so bad idea either considering the time I used on the model anyway. My goal was to the model and renders as photo realistic as possible. I did my best, but I ran into some limitations of time as well as my own capabilities with the software. In the end I did get some good enough pictures out.

All the feedback I got from my projects mentor Lee Walton, my opponent Nicklas Sundvall and my class mates was always very good and valuable. I think I should have asked their opinions more since I did not have any client for my project who would have given me some guidelines and feedback.

In hindsight there are a lot of things I would have done differently in this project. I take that as a good thing, because it just means that I have learned something.

7.2 END RESULT

I think I had some decent ideas when it came to using the technologies as an advantage. On the other hand maybe with a deeper research I could gone further with the ideas or have come up with even better ones.

I really like the basic idea of the body design, but I think it still could use some redevelopment and fine tuning. At the last stretches of this project I had many new ideas about which direction I would like to take the design and I wished that there would have been more time. On the other hand, this is just part of any design process. Every project has to be finalized at some point.

I think implementing the key features of Lamborghini to the design was somewhat successful, although some parts and details could still look more like Lamborghini to me. I did show my design to few people without logos or context and to them it looked a little bit like Lamborghini, so that was a good sign.

During this project I had an increasing feeling that maybe a completely autonomous super car without any means of driving would not make much sense. Why couldn't you have a car that has a full autonomy capabilities for driving in cities or motorways, but still have a steering wheel for driving on a race track for example. The autonomy could still step in when you are going to have a crash. Or It could be that I am just missing a trick here.

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