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Module Code M6X02237 - 2

Major Project: Design Research Manifesto

Motorsports are extremely popular and enjoyed by millions worldwide, by both viewership and participation. Formula 1 is the most popular motorsport racing series in the world which in 2019 had a total global TV cumulative audience of 1.922bn. (Formula 1 viewing figures 2019: F1 broadcast to 1.9 billion total audience in 2019 | Formula 1®, 2020) There are an estimated total of fifty-six thousand people participating in various motorsports in England (Lange, 2020) with the most popular form of participation coming from public track days.

The problem with public track days is that when an inexperienced track day driver is pushing their capabilities, or their vehicle to the limit, it can result in errors. Going onto track for the first time can be daunting, especially when sharing the track with other faster, more experienced drivers.

'Justin Everitt' the founder of 'Motorsport Race & Rally Insurance Services' provided some very interesting statistics to support this project. He said, *"10% of vehicles have an incident on track which range in severity from anything from a spin to a crash. 1.5% of those incidents leave vehicles written off and 1% of the vehicles written off also result in an injury."* (J.Everitt, personal communication October 26th 2020)

There are multiple companies running vehicle track days in the United Kingdom. The largest track day operator in the UK is 'Motorsport Vision Trackdays' also known as MSV who host over 200 car track day events a year with an estimated average of 40 to 60 cars at an event. The initial statistics provided do not appear to add up to a lot, but when multiplied by the thousands of participating motorists, it quickly adds up to a considerable figure.

This major project revolves around future track car safety.

Car Manufacturers are always on the search for new technologies and methods to keep their vehicle users safe. Automobile safety started to be introduced in the 1950's when Volvo introduced the first three-pointed seatbelt. According to figures released as part of celebrations surrounding the 50th anniversary of the invention of the three-point seatbelt, it is said to have saved more than a million lives across the world and prevented far more serious injuries. Reducing your chance of injury or death by at least 50 percent in the event of a collision, it remains the most successful contribution to safety in the history of motoring.

“Seat belts became compulsory in the UK 1983, and since then they have saved between 35,000 and 50,000 lives.” (England, 2013)

Vehicle safety technology is now one of the most important features in any vehicle and it is still expanding as technology continues to develop. Modern vehicles are equipped with safety technologies that not only protect the vehicle users in the event of error but also to help prevent the errors from occurring in the first place.

Electronic Stability Control is a very important modern safety feature that was first introduced in 1995 by Mercedes with the help of Bosch. (Auto Express Team, 2015) It is a software that has been continually developed and can automatically reduce engine power and operate individual brakes, should it detect that the vehicle is about to lose stability or traction thus keeping the vehicle in control.

More forms of vehicle safety technology come into play with the use of sensors to help both provide the user with visual indicators to prevent collisions with vehicles in blind spots, or to also allow autonomous emergency braking that will quickly slow the vehicle to prevent collisions.

One final form of vehicle technology used as a preventative measure to make sure the vehicle is in the best condition for its use. Monitoring sensors can be used across the vehicle for a wide range of purposes but one of the most common uses is to ensure that the user keeps the tyre pressures at an optimum level. Tyres are one of, if not the largest factors to how well a vehicle handles and feels, so making sure they are at the best pressure to maintain traction is key to preventing an incident from occurring in the first place.

Safety in Motorsports

“Motor sport has the power to excite and entertain millions across the world. It also has a responsibility, to its drivers, spectators and the wider public, to demonstrate the highest safety standards and to deliver the vital message that high speed belongs on the race circuit, not on the road.” - (Motor Sport Safety, n.d.)

Safety devices are very advanced in motorsports, as they should be. Formula 1 has come a long way in terms of safety since it began seventy years ago. *“In the 1960s and 70s, it was widely accepted that racing came with a real risk of severe injury or death and it took some time before the culture of striving to protect lives set in.” (Duxbury, 2020).*

One of the major pieces of safety technology in a F1 car is the ‘survival cell’. The survival cell is the central part of the F1 car in which the driver is seated. It is made out of extremely strong carbon fibre and designed to be nearly indestructible while also being able to absorb huge amounts of energy during a crash.

A recent piece of safety technology that was introduced in 2018 is ‘The Halo’. It is a cockpit protection device that can be seen on modern Formula 1, 2 and 3 cars. It was initially quite controversial as many argued that it was against the DNA of single seater racing. However, after some serious events including Jules Bianchi’s 2014 crash in Japan it was deemed very necessary that some form of cockpit protection was needed.

My proposal is to design a futuristic concept vehicle that shows how vehicle safety can have an effect on exterior design.

Below are a series of case studies that show how vehicle safety can have an effect on an exterior design of a vehicle.



Figure 1: Lamborghini Terzo Millennio

The Terzo Millennio is a concept super sports car designed by Lamborghini with collaboration with researchers from Massachusetts Institute of Technology (MIT). They envision the idea of the Terzo Millennio being able to selfheal and repair damage suffered to its carbon fibre components. With large advancements in technology and carbon fibre, they could embed nanotubes within the carbon fibre that are able to channel resin to any detected damage or weaknesses that have occurred to the body of the vehicle, Comparable to the human body and its blood vessels. The name 'Terzo Millennio' is Italian for the third millennium and the concept vehicle does appear to be designed with the far future in mind. The shape is outrageous with crazy surfaces on show with violent intakes and overlapping surfaces all over the vehicle.



Figure 2: Self Balancing Honda Motorcycle

Honda is pioneering a new technology called 'Honda Riding Assist Technology'. It is a unique feature in which the motorcycle continually assesses its position and adapts with tiny steering inputs. It can also lengthen its wheelbase by adjusting the front fork rake. Honda has derived this technology from its humanoid robot, ASIMO.

"By the motorcycle balancing itself, touring and motorcycle life is made easier, and more fun, without sacrificing the fun of riding. The Riding Assist-e is powered by electric motor. This model marks a step towards realizing Honda's 2030 vision of "enjoying the freedom of mobility" and "a carbon-free society." (Honda Global | Honda Riding Assist-e, 2017)

With Honda pioneering this technology to assist the user, it could be seen as an element of safety as it takes away part of the physical requirement needed to balance and therefore minimizing the human error. With the technology making the motorcycle constantly adapt to its situation to hold balance, it makes the flow of the design change depending on its current situation which could be a large factor into how the motorcycle is designed and could be something to think about in this project.



Figure 3: Pininfarina Nido Concept

Pininfarina designed a concept car called the 'Nido'. It is a city car that was designed to explore a creative idea with the goal of increasing both internal and external safety for both the occupants and pedestrians in the event of a collision.



Figure 4: Pininfarina Nido Concept Principle

The innovative concept is composed of three elements: The body, the sled and the absorber. The occupants when using the vehicle are sat within the sled, and in the event of a collision the sled is able to move up to 350mm forwards and 120mm backwards through the use of the energy absorbing material between the sled and the body.

"This concept was in fact conceived through an intense collaboration between design and engineering, two poles often opposed, with the singular goal of creating an attractive, small and safe vehicle." (Pininfarina Nido Concept (2004) - Car Body Design, 2008)

The idea behind showing off the concept through the styling of the vehicle is something I will keep in mind with this project.

Design Ideas

Below are the three sets of ideation sketches for the design proposals.

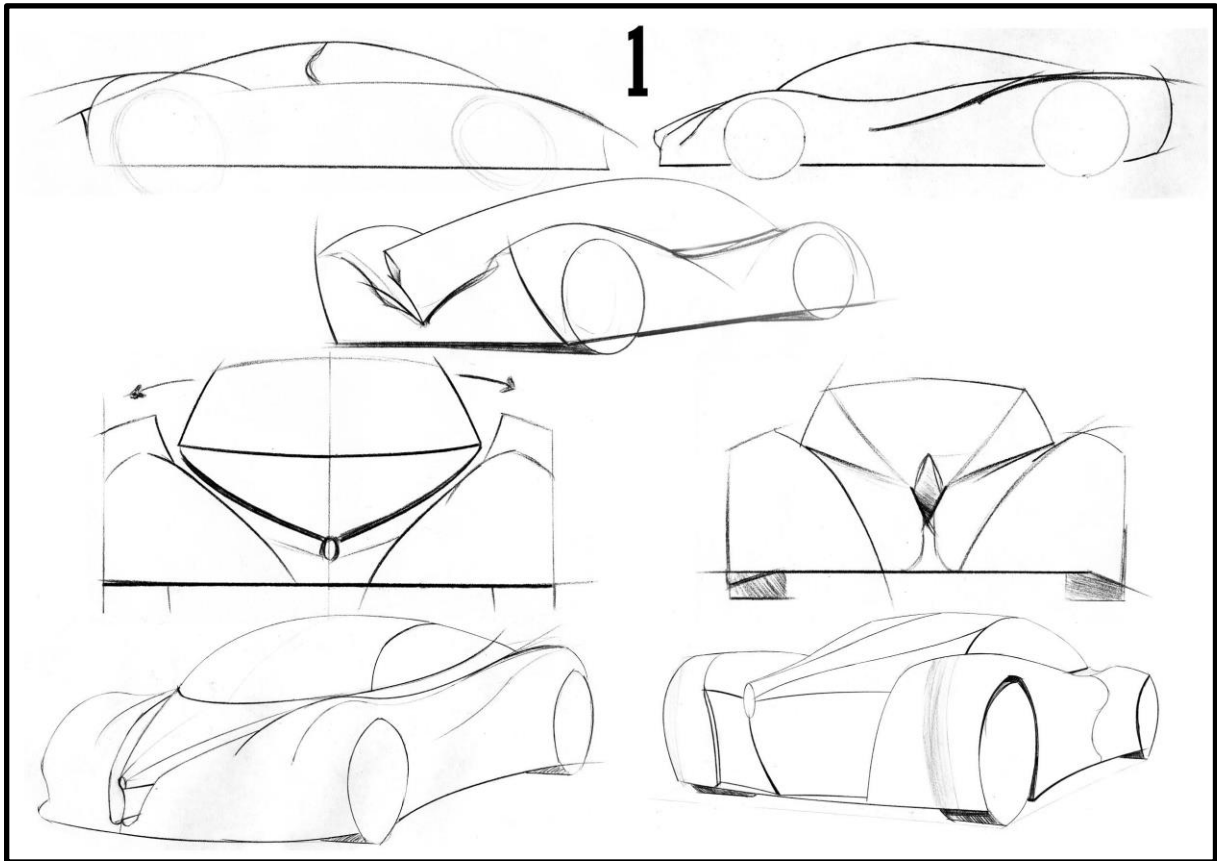


Figure 5: Ideation Sketches for Proposal 1 - H. Cranstone

My first idea is an electric super sports car set around the year 2050. It would have electric motors at all wheels, this would allow for AI to instantaneously correct for when the user puts the vehicle into a situation leading to a fault. The main feature for this vehicle is the cockpit that is able to pivot from side to side like a motorcycle would when cornering to allow for a distribution of weight to maintain traction over the tyres that need it most. Not only would the pivoting cockpit allow for greater grip when cornering but the central body of the vehicle would also be able to withstand an impact from the side, the same way the Pininfarina Nido does.

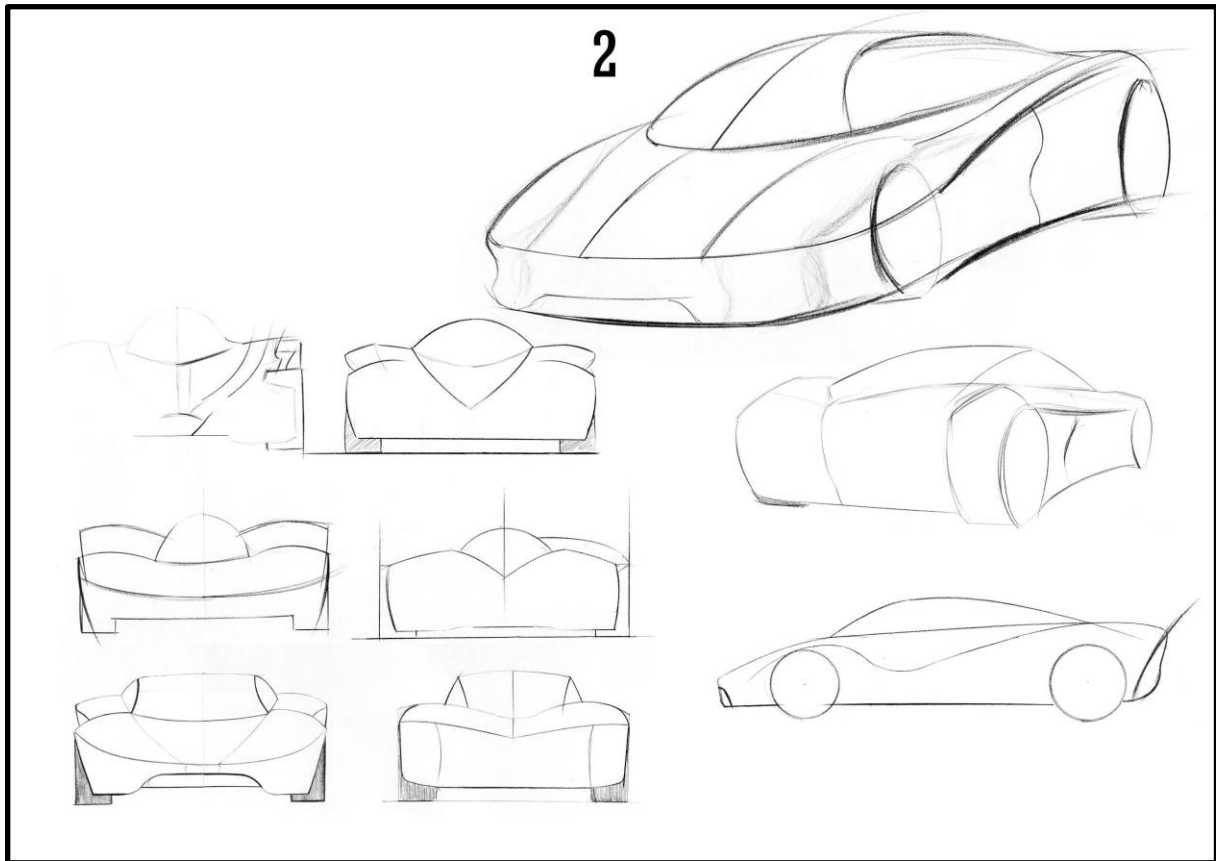


Figure 6: Ideation Sketches for Proposal 2 - H. Cranstone

My second idea is based around a future mid-engine sports car. This concept has very flat top surfacing with large radius curves. The intention for this design to have the body work able to move to increase downforce. Active aerodynamics affecting the surfaces all over the top of the vehicle would make the vehicle quite dynamic looking as it would be quite subdued when still however completely different and lively when it starts moving. The concept would allow for a safer track vehicle as the constant downforce would be able to counter a sudden lack of traction and if a crash were about to occur it would be able to prevent it from being far more severe.

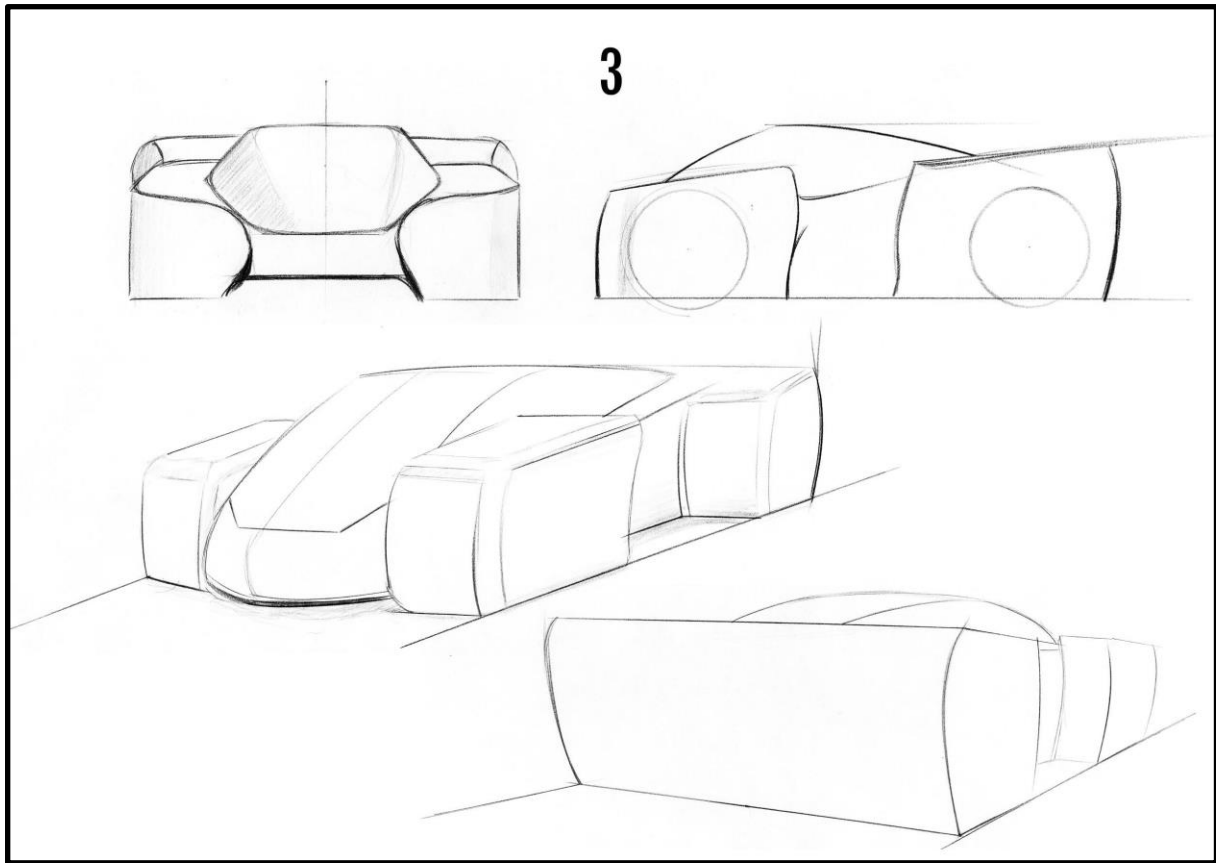


Figure 7: Ideation Sketches for Proposal 3 - H. Cranstone

My third idea is set far in the future. The concept has large volumes surrounding the cockpit, each of these volumes will be designed to crumple on impact to absorb the energy of the crash. This proposal would not be as supportive as the previous proposals as this will not prevent the accident. However, if there was an error and crash then the volumes would protect the cockpit in the event of an emergency. Once the emergency is over, new volumes would replace the damaged ones allowing the user of the vehicle to return to the track.

Chosen Proposal and PDS

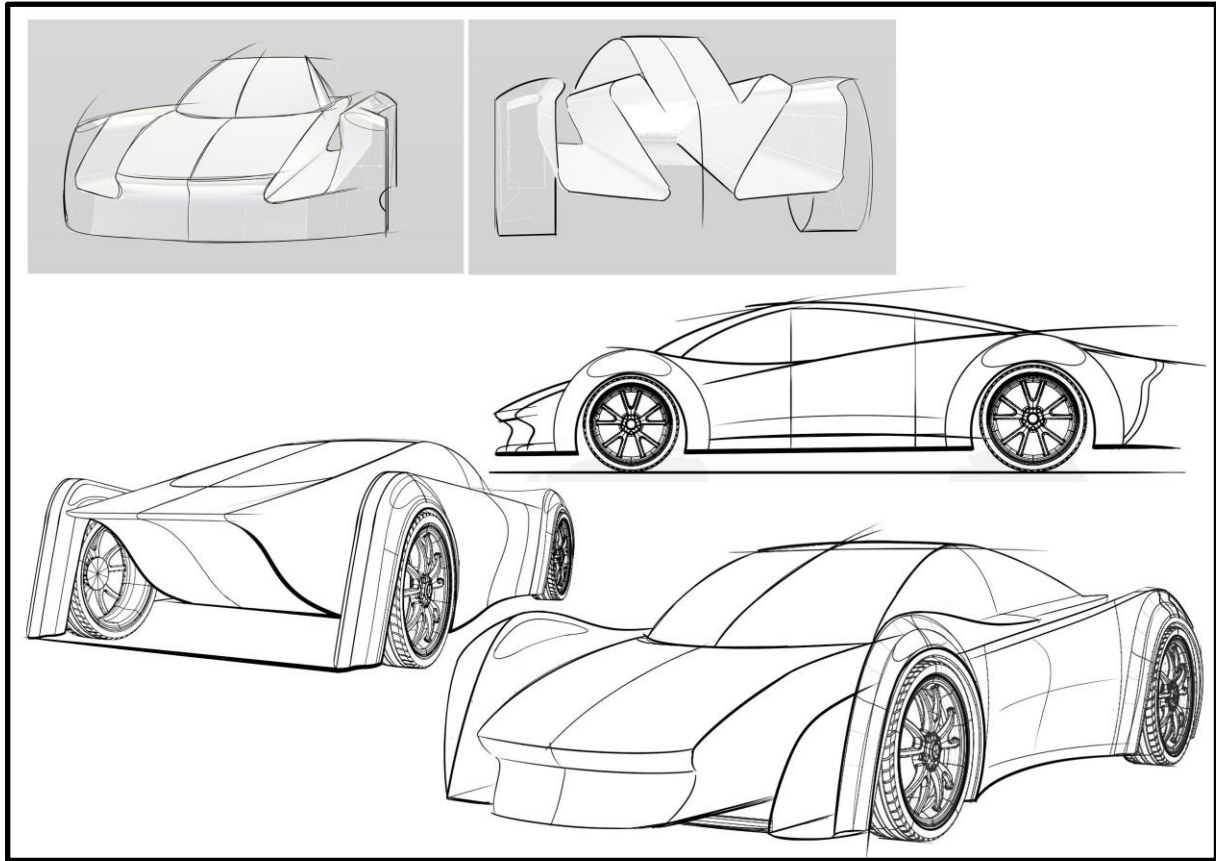


Figure 8: Chosen Proposal - H. Cranstone

Out of the three proposals, I have decided to continue with proposal one. I believe it has the most promise out of the 3 with it being so unique.

The proposal still needs work however so the design will continue to develop. I intend to continue to work on the side profile to blend in the arches which will modernise the overall aesthetic dramatically. I will also be adjusting the central pod by narrowing the front to make it more streamlined and sports like along with finishing off the rear of the body to blend in the rear diffuser. Narrowing the front will also give more clearance for the front wheels.

Other things that may be worth considering going along with my project consist of a special helmet that pairs to the vehicle, so the user has a heads up display in their peripheral vision, and also the possibility of a racing series with its own rules, aimed at concept vehicles to try and push new concepts designs and technology into reality.

I believe this concept will make track days far safer as it will allow any driver to take control and instantly push their limit safely without the constant thought of them wondering if they are being safe and without the thought of their vehicle being damaged if they make an error.

Part of learning is making mistakes, but this vehicle should allow you to make mistakes safely.

Product Design Specification

Target Customer: Motorsport enthusiasts.

Aesthetics: Futuristic and dynamic.

Ergonomics: Single seater vehicle.

Length: 4470mm Width: 1970mm Height: 1120mm

Weight: 1750kg/3858lbs

Performance: Scaling with Driver Capability.

Environment: Track Use Only.

Production Quantity: 50

Target Production Cost: £600,000

Launch Date: 2050

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