

Major Project: Design Realisation and Communication. Design Evaluation Report

My project rational is to design an original, imaginative, hyper-estate vehicle, whilst emulating Lexus' distinguished spirit and passion. The Lexus brand was conceived in 1989 when elite, Toyota designers and engineers were handpicked to work under the freshly conceived Lexus brand. Clifford, J, (2019). I propose my "LF-X" will benefit from the pioneering technology that provides sustainable energy in the form of a hydro-electric drivetrain and powered by 4 brushless motors in the all-wheel drive set up. The extraordinary central front driving position will empower a unique adventurous drive, an additional 4 rear seats and a rear central ISOfix car seat point meet the demands of most modern, flexible families. There will be an initial production run of 10,111 vehicles to make production costs viable, whilst offering an affordable purchase price to families.

Throughout this design process, the research, development and ultimately the final outcome, I have strived to keep the driver's needs and values at the forefront, so that every factor upholds and directly contributes to the ultimate driving experience. Lexus recently ran an advertising campaign "it's how it feels" the campaign, spot lighted in their Lexus UK Magazine Upton.M.(2020). It specifically promotes their all-electric compact luxury SUV and range of hybrids. Their advert visually and psychologically puts the audience in the driving seat. They empower you, as a viewer, to be virtually propelled into the car, to take control of the steering wheel and question "what does it feel like?" all whilst sat watching the advert. Graphically they cut in oversized luminous advertising boards, reinforcing the message to infiltrate and stimulate your senses.

In order to achieve the ultimate driving experience, I researched current perceptions regarding placing the driver in a central sole seating position. In an article in Car and Driver, Eric Tingwall wrote an informative, impartial article "Driving from the Middle of the Car Is About to Make a Comeback" Tingwall, E (2020) Tingwell, referencing McLaren F1, raises some relevant, significant, arguments relatable to the general motoring industry. The information he provides, confirmed my initial thoughts to place the driver at centre of the vehicle for several reasons. Fundamentally, it is financially cost effective especially when competing in the worldwide market as it eliminates the need to duplicate the design and production costs of building both left and right-hand driving versions. Historically, McLaren are perceived as the innovators of placing a driver in a central seating position, their reasoning behind this is both relevant and feasible for my design. Similar to the F1 McLaren my LF-X was designed with a slight curvature in the roof, as a consequence the maximum headroom is at the crown of the curve, which is directly above the central driving position. This will be most welcome to taller drivers as it provides them with a few centimetres of additional headroom. Furthermore, comparable to being on a racetrack, when driving on motorways, dual carriage ways and urban roads the central driving position improves the visibility around both left and right-hand bends. On the contrary though this can reduce visibility in city driving or when in traffic, to maintain safety standards, this can be easily remedied by increasing the distance from the car in front. A central driving position whilst not illegal on UK and US roads certainly challenges current perceptions and expectations. However, so did the first motorized vehicles when they started to replace horse drawn carriages.

From a passenger safety point of view, the centre of the car is the last point that will be affected from a side impact. The practical value to this is that it affords the driver a greater chance of survival thus enabling them to possibly have some control over their reactions to terminate the vehicles movements and avoid further damaged to any occupants or pedestrians.

Tingwell, also highlights “that special feeling” he explains that both Ford and Chevrolet’s mid-engine supercars are defined by the central driver. He quotes Andy Palmer, the vehicle line director for McLaren as saying, “It’s quite special sitting in the middle of the car,” “It gives you a good appreciation of the positioning of the vehicle on-road and on-track as well.”

Despite the pre-mentioned advantages there is inevitably going to be many downsides, such as the understandable, opposition from road users, consumers and safety experts to anything that involves change. One key issue is that of the accessibility of the central driving seat. The driver would indeed need to be agile, this is because the seat is not immediately adjacent to the door threshold, as in conventional cars, they would need to be able to climb in as opposed to merely sit in. This does not for one moment mean the intention was not to be inclusive, as it is unavoidable that this style of vehicle will not suit every driver just as in the same way 2-seater low stance sport car is not accessible to all. On a positive note of inclusivity, I have designed the doors with a sensory automatic opening capability. So, passengers with limited manual dexterity, impaired fine motor skills, carrying shopping or holding a child will not have to struggle with door handles.

I have chosen the Lexus brand in which to invent my own model as I hold them in high esteem as a car manufacturer. Jared Rosenholtz wrote for Car Buzz an unprejudiced article entitled "What is the Secret Ingredient That Makes a Lexus, a Lexus?" Rosenholtz, J. (2016) He wanted to expose Lexus' distinctiveness and uniqueness. He started honestly by reminding the reader that historically Lexus was viewed as just a Toyota with added gimmicky frills and fancies and sold to gullible, older customers. Rosenholtz did then continue by observing that currently Lexus is a brand to be respected as a unique, automotive fore runner. His remarks were made after spending a week trialling a sample of the Lexus fleet such as the IS350 and RX450h. It gave him a balanced insight into what sells the Lexus brand. He further explained that Lexus retains its "bread and butter" range, GX/LX SUV's, CT hatchback, that are still built encompassing the original Lexus philosophy and tremendous extravagance, appealing directly to their brand loyal lifelong customers. This is a cohort of faithful customers that are happy and willing to pay for the indulgent, exclusive, extras that are presented in a Lexus, as opposed to paying the high prices attributed to buying from Mercedes, Audi or BMW that offer high-performance, speed and powerful vehicles, that they have no need or desire for. Rosenholtz concludes that what make Lexus stand alone is their reliability, simply because their technology is second to none.

My original chassis dimensions were 5000mmL 2000mmW and 1500mmH, following research and developing my plans I have now reduced them to 4995mmL 1950mmW 1460mmH. It is especially important to get the balance right, the interior must have sufficient space for a family's needs, yet the external dimensions must be practical for driving and parking. Our family home was built just 25 years ago,

yet the only vehicle that fits in our garage is my father's 1968 Triumph Herald Convertible. Whilst researching the average car dimensions I came across an article that Richard Bremner wrote for Auto Car, Bremner, R. (2019). In it he was highlighting the changes, issues and difficulties of 21 Century motoring such as home garages, parking bays and country lanes. He states the current Volkswagen Polo, has greater dimensions than the original 1974 Volkswagen Golf. The technical reason vehicles are getting bigger is to conform to the current rigorous crash test regulations, there has to be a percentage of "controllably crushable bodywork", whilst also considering pedestrian protection. In addition to this Bremner also observed that people are getting bigger, taller through better education on nutrition and unfortunately wider due to the plentiful availability of cheap high calorie fast food. So, whilst cars need to be designed to accommodate, 21st century safety standards and enlarged occupants, it can be argued that some vehicles are now unreasonably vast such as The Range Rover Vogue, the BMW X7 and the Mercedes GLS. This becomes an issue when factoring in that many of the roads we still drive on today were built between 50 -100 years ago ideal for the smaller vehicles of that time.

According to an article in Pressreader (2019) Jonathan Turley from the Highways Agency stated in 2011 that remarkably there is no definitive ruling, or standardisation as to the width of UK roads. That said he did state there are specific design documents that clarify classification of roads with regards to traffic volume, the type of traffic and the predicted traffic.

I have taken the emotional and physical inspiration for the LF-X from Sanctuary II which is Thanos' ship in Marvel's Infinity War. In a poetically descriptive piece in Fandom (2020) the writer elegantly connects the rationale between Sanctuary II and my own thinking behind the vision for my hyper-estate.



The ship itself represents a large vehicle that independently transports people and luggage, it symbolises Thanos' expanding empire mirroring a modern growing family. The powerful star ship is perceived as one of the most dominant in the universe. It is built from quality materials, with preservation and protection of its passengers a priority. Equal to my design it is perfectly energy efficient, high performing with extensive power. It possesses advanced technical, communication and operational technology. The primary dominant feature of Sanctuary II is undoubtedly its silhouette, with its outstretched, binary wings. I sought to use this shape and contour to model the rear taillights. The rear end of a car has to be eye catching, impactful and memorable as it is probably the most viewed angle, and the last thing other roads users see when being overtaken.

As Lexus has its culture and heritage firmly in all that is Japanese, I wanted to embrace the culture so looked to their customs and traditions to inspire details to embody in my design as a mark of connection and respect. The silhouette of the Sanctuary II was perfect for the rear lights, but I felt the ends needed to be cleaner and crisper. Unique Japan website featured an article on Japanese Swords. Kuntz, P. (2020) The ancient philosophy behind their swords believes, they are a “pure object” “constructed by human hands and spiritual energy” Japanese Swords are held in the highest esteem, it is an honour and privilege to possess one and the sword is cherished by its owner. There is a hypothetical comparison between Kuntz’s explanations of the belief that the sword is a symbol of a modern-day warrior, “a master at handling life’s problems and overcoming any obstacle” and my original vision, the creative journey I have undertaken, and the final manifestation. I endeavoured to produce a vehicle that not only empowers the driver to be fearless and tackle life head on, but also to influence the future of the automotive industry.

Constantly striving to improve the aesthetics on my car, I wanted to clearly define the tips of the rear lights. In Japan every handcrafted sword has a unique style on the tip, I particularly like the form and shape of the Hamon Midare-Gunome, Dellinger, CZ(n.d.), details the



craftsmanship, explaining it is handmade from Carbon steel, which is chosen for its durability and ability to retain its sharp edge. To achieve this it undergoes 14 precise,

systematic processes of sharpening that results in the traditional, time honoured, razor sharp, mirrored finish. I took the profile of this tip. The Hamon Midare-Gunome and merged it with the design from The Sanctuary II. I now have a taillight feature that is a collaboration, deep rooted in Japanese history and at the same time echoing a futuristic age.

Another part of my design development was the addition of 2 functional fender vents. Having created this hyper-estate, I needed to insure it delivered the full experience to the driver as promised, not only to keep the braking system efficient but also to maximise the aerodynamics. Although Bimmertips (2018) explain the benefits from the perspective of a BMW I believe the information is still both relevant and appropriate for my own design. The fender vent will provide a rapid pathway for the hot air, accumulated by breaking, to escape, thus dragging cool air past the breaks and creating a constant stream of convection, consequently increasing overall efficiency. However, the primary function of the fender vents is to release the air pressure that has built up inside the wheel arches, if it is not released it can cause unwanted aerodynamic lift. This is in part due to the 2 air intakes I have now placed in the front bumper, which are needed to control the flow of air over the brakes to keep them cool, this air then gets trapped at high pressure in the wheel arches, the high pressure creates the lift, and the resulting force is then a lack of traction. So, by adding the extra fender vents, the pressure is alleviated, and the front of the vehicle remains stable thus providing the necessary road grip. Furthermore, Bimmertips continue to explain that air pressure also creates aerodynamic drag. This will reduce performance efficiency, in particular fuel economy, (or in this case less energy need therefore greater battery life remaining) as the air flow is opposing the direction of the car. One final point, without the additional fender vents, the internal vehicle noise will

be somewhat greater, something that certainly needs to be kept to an absolute minimum when marketing a luxury prestigious vehicle.

Many families are now very aware of environmental issues and for most people financial budgeting and disposable income are top of their priority lists. What Car (2020) concurs what is needed is an electric vehicle that can provide generous storage space and deliver an efficient, rapid, viable recharging system. In addition, it needs to support and provide for the daily demands of commuting, school runs, recreation, entertainment and status. Then this would be a vehicle that would benefit the forward thinking, environmentally supportive and aware family.

Taking environmental sustainability into account led me to choosing carbon fibre for the undertray, inner arches /rear bumper and front grill. Carbon fibre being lightweight yet durable is perfect for automotive construction. A lightweight vehicle takes less energy to move therefore less drain on resources. However, it is not that simple, an unbiased article Ijtpedersen (2017). highlighted some of the issues. Extreme high heat is needed in the manufacturing process and there can be 30% product wastage. There is no current system in place for recycling at the end of the car's life. They do state that as a new technology any future advances and financial support will only strengthen its economic viability. Indeed there are now more manufacturers appreciating the benefits of carbon fibre with Porsche using it on their racing cars Casey, T (2020) "what you see zooming around the race track of today could be parked in your driveway tomorrow."

The choice of energy for fuel for the Lexus LF-X is Hydrogen fuel cells. The cells being Graphene cells as opposed to Lithium, the key reason being Graphene is far safer, they do not overheat or overcharge due to the high rate they conduct electricity. In an article in Android Authority Triggs. R (2020) Robert Triggs explains

whilst both batteries use “two conductive plates coated in a porous material and immersed in an electrolyte solution” they have very contrary traits and behaviours. Graphene is tough, robust and far more stable so the cells can charge at higher speeds, supply the high currents needed to power vehicles, and retain a cooler running temperature. Whereas Lithium can easily puncture and are highly flammable and volatile, they will also overheat and can easily be over charged.

More recently attitudes to Hydrogen fuel cells are definitely changing, and opinions are swaying. The feasibility of them being used as not only a viable fuel for motor cars but as the exclusive fuel of the future seems to be becoming a reality. An article back in 2014 in Consumers Reports (2014) encouragingly stated that vehicles powered by Hydrogen would see a relevant reduction in fuel costs, the only “emission” produced would be water and there was an infinity of renewable resource to create Hydrogen. However, they adversely pointed out the many damming issues, such as the overly expensive process needed to make the Hydrogen, produces vast amounts of CO₂ emissions, the high costs involved in transporting Hydrogen and the serious lack of the necessary fuel station network to sell Hydrogen to the motorists.

Fast forward to 2020 and a recent article in Auto Car Crosse. J (2020) acknowledged that whilst the concept of Hydrogen had been initially slow to make the respectable impact it deserved, in January 2020 The Hydrogen Council, boldly stated “the 2020’s will be the decade of hydrogen” The Hydrogen Council consists of worldwide companies such as Audi, Mitsui, Toyota and Faber Industries, with a unified goal for long term cleaner energy. Currently Honda, Hyundai and Toyota are the only manufacturers producing vehicles that are powered by Hydrogen fuel cells.

The article acknowledges that achieving an acceptable level of filling stations had proved to be the most difficult issue. However, globally there are realistic plans for hydrogen to be a main factor when considering fuel for all vehicles, such as trains and ships, heating domestic and industrial and vitally to store surplus electrical energy. The greater the demand for Hydrogen fuel will ensure the network for supplying the fuel will be achieved. Furthermore, there are 3 types of hydrogen, Scott, M. (2020) grey that is made from methane but produces harmful greenhouse gasses that pollutes the atmosphere; blue which offers some balance in that they harness the emissions from the grey and stockpile them under the ground; green by where water is split using electrolysis and renewable energy (solar and wind turbine).

For the frame I have chosen aluminium, it is lightweight, durable, recyclable and cost effective. The Aluminium Association (2015). Confirms this and goes on to say it is now the first choice of some of the leading car manufacturers. Also, that whilst steel is still the most used material aluminium is a close second, approximately 90% can be recycled, using aluminium on an average production run saves the equivalent of 108 million barrels of crude oil in energy, aluminium absorbs double the energy in a crash.

In conclusion with the combination of passion and technology from the fundamentals of the Lexus brand combined with my own passion and crave for future technology I believe I have created the next step towards the answer to an economical, practical yet high performance vehicle for all the family to enjoy.

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