

Major Project Manifesto:
A Contemporary Solution for the Sámi

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BA Automotive Design

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Presented in this manifesto is my major project concept design, inspired by a short holiday I took with my family in February 2019 to the North Norwegian island city of Tromsø. The city is an interesting place for anyone with a passion for design, as a range of traditional and contemporary architecture and art can be seen. A notable landmark, the Tromsdalen Church (commonly known as the Arctic Cathedral), was one of the main motivations for my visit as I had previously studied it as inspiration for a Graphic Design A-Level project.

Designed by Norwegian architect, Jan Inge Hovig, the cathedral was constructed in 1965 and features contemporary staggered, triangular structures fashioned from concrete and metal. However, despite its impressive form, this building isn't the reason why this holiday is relevant to my major project. One evening while there, we joined a guided tour to travel an hour north of the island for the opportunity to see the Northern Lights whilst experiencing the local, traditional Sámi culture on a rural reindeer ranch. Sámi are the indigenous people of a large area comprising parts of northern Norway, Sweden, Finland and Russia and their traditional industry is reindeer herding. A large number of Sámi people commit to an annual cycle of migration, herding the reindeer between their winter pastures and summer calving and grazing grounds at the coast and not only utilise the animals as their business, but also for food, clothing and tools. The Sámi begin their careers as young adults (aged between 16 and 21) and is often a lifelong occupation, carrying out herding duties beyond average retirement age.



(Above: The Arctic Cathedral/ Tromsdalen Church)

So, what is the relevancy of the Sámi people and their culture to my concept? My design constitutes a small utilitarian vehicle developed as an upgrade to the transportation the Sámi use today, i.e. skidoos or snowmobiles. My concept offers solutions to some of the problems with their current chosen method, which I will discuss in more depth in the following pages.

Increasingly over the years, governments have interfered in the Sámi way of life and encroached on their lands. In the 1970s, the Norwegian government introduced skidoos to the reindeer herders as a perceived improvement to their traditional travel methods. It was initially thought that this initiative would be met positively by the Sámi, however research reports this move was met with a mixed response (*Reindeer herding in Norway*, J. Foster). Prior to this time, Sámi people had generally not used any sort of automated technology, relying on their traditional use of reindeer and dogs to haul sleds. The introduction of skidoos presented a new challenge to the Sámi, with a large initial investment for the vehicle and then regularly having to refuel the tank and generally maintain it. The new technology was mistrusted and immediate complaints were raised about the noise pollution caused by the motor of the snowmobiles, which was scarily alien to the reindeer and caused upset to the herd. As time went on, it was found that while many reindeer became familiar with the

noise, younger and more nervous animals were still affected. A second environmental concern about the use of skidoos was pollution produced by the engines. Most of these vehicles originally used a, now obsolete, two-stroke engine, which was lighter and simpler so easier to maintain. However, they also produced a notoriously high level of emissions compared to alternatives. Pollution from this type of engine is particularly high for two reasons. One is the combustion of the oil, which is the factor responsible for the visible smoky emissions present when these engines are running, and seen to an even greater extent as the engines age and become more worn. The second reason is the leakage of hydrocarbons from the exhaust port whenever a new charge of air and fuel enters the combustion chamber.

A further disadvantage of the design of the skidoo as the Sámi's primary vehicle is the lack of storage space.

The introduction of skidoos was intended to assist the Sámi people in herding reindeer as they travel long distances on their migration trip, and other occasions. However, their work involves having to stay consecutive nights in the wilderness, often in harsh conditions. The size and design of a skidoo means it cannot provide shelter for a single person for a night, nor carry all the supplies and equipment required for both the reindeer and accompanying humans for the journey.

To address the short-comings of the skidoo, my design strives to overcome all primary issues the Sámi people experience with their current mode of transport which are outlined above - noise pollution, CO₂ emissions, the requirement for limited resources and the lack of storage and luggage space or temporary accommodation. To jointly address the first two of these issues, I am basing my design on an electric drive train meaning my vehicle will produce zero CO₂, which solves the pollution issue. Additionally, this significantly reduces the level of sound emitted, thus answering the problem of young and nervous reindeer being scared by the skidoos and contributing to a more peaceful environment. I have targeted the problem of space by designing a vehicle that is larger than a skidoo, although still manageable and manoeuvrable, and with a sensibly organised interior layout resulting in significantly more cargo space.

Addressing the problem of pollution is one of the key challenges for my design, as well as being a hot topic in automotive design and indeed the most significant current global issue. Although an electric vehicle platform could be considered an uncreative and safe environmentally friendly option, I believe firmly that my specific target audience and operating area would be particularly open to using an electric vehicle as Norway is the torch bearer for the world in electric vehicle (EV) infrastructure (in addition to being the leading EV owning country in the world). Charging points are widely available, even in the far north. The government of Norway initially launched a campaign backing 'green' cars back in the 1980s when they employed the country's internationally famous music group, A-Ha with their song 'Take on me' to promote the use and vision of electric vehicles. In the following decade, the 1990s, Norway's promotion of EVs intensified when they hosted the 1994 Winter Olympics in Lillehammer and paraded ten examples of progressive vehicles of the type during the event, which resulted in a significant step up in EV and hybrid awareness. In the following years, the Norwegian government has remained committed to this cause and introduced measures to increase the appeal of owning EVs, such as excluding these vehicles from annual road tax, introducing legislation to enable the use of EVs in bus and taxis lanes, granting free parking and waiving toll fees. In addition to the advantageous treatment for EV owners, the Norwegian government recognized early that the charging infrastructure would be essential to developing and maintaining a successful EV society. Norway is a leading country for renewable and clean energy as their primary source of electric energy is hydropower (the process of electrical energy being produced from the flow of water). The natural geography of the country with steep valleys, abundant rivers and heavy rainfall mean this is relatively easy for Norway to achieve. Their government aim to stop the sale of fossil fuel driven cars by the year 2025 and outside of the automotive industry, all short haul and internal flights are striving for electrically power transit by 2030. In Nærøfjord, the county's first electric passenger boat is in service as part of an effort to create the surrounding region into the nation's first clean energy zone by 2026.

Norway's neighbours, Sweden, had a higher level of electric vehicles sales nationally back in 2010, yet today Norway outsells Sweden tenfold (*Norway is leading EV owning country in the world*). Although the two countries are similar in climate and location and Sweden is much larger, Norway has the advantage of a longer coastline including their iconic long fjords. Sweden's early efforts to increase EV sales have since faced the

major challenge of the fragile state of their power infrastructure. Sweden also have ambitions for clean energy, but without the same level of natural water resources their neighbour enjoys, they have instead committed to a programme of increasing wind power. Nuclear reactors are being closed and the country is now operating on a limited source of electricity. With increased demands on electrical supply as traditional power sources are shunned for cleaner alternatives, Stockholm and other major cities in particular are demanding a growing level of electricity that the nation is struggling to provide. Solutions currently suggested are as dire as limiting times that charging points are usable (*Why little Norway leads world in EV usage, D.Nikel*). In addition to their natural geographical advantage, Norway had considered similar problems earlier and set up the infrastructure needed prior to heavily promoting electric vehicles, and ensured they had a major clean energy resource to fuel this revolution. Although the Sámi territories span across Sweden, Finland and Russia in addition to Norway, and my design was conceived with my Norwegian experience in mind, I believe the global climate crisis and the championing of this cause by Scandinavian countries mean current potential barriers to my concept vehicle regarding infrastructure will be overcome in time as other countries follow Norway's lead.

Looking at the profile of my design, there are three key styling lines that flow horizontally throughout the entire length of the concept. At the front is a sleek sharp edge above the lower glacis of the face. As you follow the three lines, the lowest one drops after the front wheel arch and then curves upwards to form the lower surface of the side pods. The central line goes out wide from a bird's eye view then smoothly merges back into the profile of the vehicle, and the top line has just risen a little then forms an almost straight line to the rear. After the side pods and rear wheel arches the styling lines all merge into a clean parallel horizontal rear end, which flattens into a truck bed providing space for additional equipment storage and cargo capacity. My concept vehicle features an enclosed cabin, the design based on a greenhouse and representing an igloo or a lavvu (a structure similar to a tepee used by the Sámi for shelter). It has a large smooth domed surface encasing the vehicle and a triangular extension that was primarily inspired by a lavvu and also reminiscent of Tromsø's Arctic Cathedral. The cabin positioning is inspired by tank turret bustles, which were used for extra space, as is the case in this design. The feature of an enclosed cabin immediately demonstrates an improvement over the skidoo, which at best has just a small windscreen for protection. This weather-protected cockpit is shielded by a smart glass windscreen, of which the glass incorporates Quickclear technology, an electronic demisting method for keeping vision clear. It has been developed for use by Ford Motor Company and comprises tiny electrically heated wires set into the glass that rapidly clear condensation from the windshield. This is particularly useful for my concept vehicle, which is designed for use in conditions in the Arctic Circle where the outside temperatures can be extremely low. The interior space holds a semi central driver's seat surrounded by all necessary controls. The chair has a four point safety harness, designed to reduce risk of injury as the vehicle is capable of travelling over rough terrain. Other features include the ability to rotate to facilitate easy and fast access via a near-side door, or spin through 180 degrees to go through to the mid-section of the vehicle. This area features a modest cargo hold and collapsible sleeping arrangements. Lastly, the rear of the vehicle houses a rear access hatch.

From researching a previous study on Sámi herding reindeer in Norway (*Reindeer herding in Norway, J.Foster*), their annual cycle and movements across the Northern regions of Scandinavia are specifically documented. Throughout the winter, at a significant distance inland from the fjords, the herds are settled on ranches and in fenced fields. This period usually lasts from October until April the following year. During the spring months of April to June, the reindeer are migrated towards the coast where calving will take place. Summer brings freedom for the herd, being based on the coast on good pastures from June until September, where the reindeer sometimes swim out to small, uninhabited islands. Much like spring, the autumn season is short, September and October, although is the most stressful time for the animals as there are now teen males trying to establish dominance over the herd. The youngest calves are a priority for the Sámi herder. Understanding the movements and land covered in the reindeer herding process is key to defining the best form of tyres to use in my design.

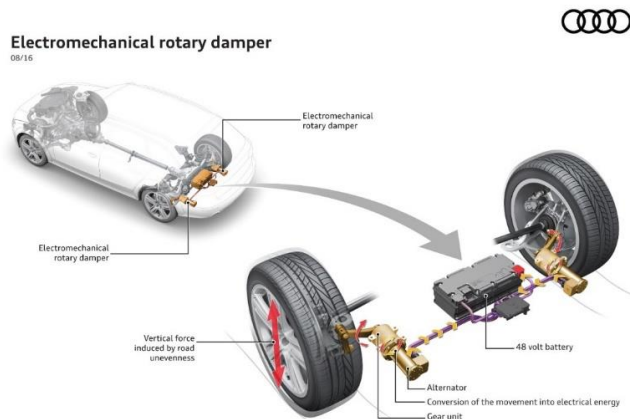
The key to being able to travel over soft ground is ground contact surface area, a concept I discovered via a tank historians YouTube video (*Nick Moran's Q&A video series*). Note, he talks of a commander climbing out of his M1 Abrahams (an 80-ton main battle tank) and when he stood beside the tank he started to sink in

to the mud flat, but the much larger and heavier tank did not. This was because the man's boots did not disperse his body and equipment mass on the low-pressure surface of the soft terrain. In contrast the tank has two sets of tracks running the entire length of the vehicle which are 635mm in width (each track covering a sixth of the tank's entire width) to spread a bigger ratio of weight. A similar concept can be taken from the natural world, in fact from reindeer themselves, as their hooves spread when coming into contact with the ground thus creating a larger surface area so they do not sink in the soft snow.

After researching past and present concepts for transport on snow, I have created my own custom system as I feel that none of the alternatives or mainstream technologies currently available suit my vehicle. I considered an experimental system that involved large metal barrels with a screw pattern embossed on the surface, which would move forward and backward when rotated. I also looked at traditional and popular caterpillar tracks, but although they have a proven history, the system is high in energy consumption and their road quality and performance is lacking. I believe the potential of the simple wheel has not been exploited fully and in my design, develop this to create an innovative solution.

I have conceptualised an adaptation of Michelin's airless tyre, which is currently in development for launch in 2024, featuring "a composite material mixing rubber and a high-strength resin embedded fiberglass" (*Michelin develops new airless tyre, J.Golson*). The behaviour of these tyres is similar to a semi-flat tyre, compressing the bottom face of the tread creating a larger footprint. Benefits of using this contemporary design include improving fuel economy, prolonging the life of the tyre itself and its immunity to puncture as the entire idea is based around airlessness. Compared to traditional tyres, production requires fewer raw materials and is less energy intensive. As one of the themes of my concept is for my design to have as low an environmental impact as possible, this is a significant improvement in contrast to the pollution emitted during the production of rubber tyres. I have developed Michelin's design to introduce a number of flat arms mounted around the tread surface of the tyres. Positioned to point horizontally outwards of the vehicle when face on, they provide additional surface contact area that would help my concept vehicle perform on snow as well as other soft terrains. The arms will be attached using lockable hinges, which can be adjusted to be folded and fitted into a vertical position, overlapping each other to form the rim of a wheel. This position would be employed for road use as it would enable the concept vehicle to drive more like a road car and will be a suitable road regulation width. At the centre of the tyre will be a carbon fibre wheel, the composite chosen as it is an industry proven material that fits my particular brief well, being light in mass, strong in durability and resistant of the low temperatures.

Connecting the wheels to the vehicle is the suspension. For this design, this comes in the form of heavy off-roading independent shock absorbers integrated with a simple and efficient way of gaining additional clean, electrical energy. Again contributing to my green theme. Back in 2015, Audi developed a pre-existing concept of using kinetic and thermal energy produced by a shock absorber whilst in use and convert it into clean energy (*Here's how Audi's new technology harnesses suspension movement to boost MPG, D.Tracey*). Dubbed eROT, the process it goes through is as follows: a lever is connected to the vehicle's suspension and when in action rotates via a gear set, going from lineal to rotational motions; this in turn spins a rotor in an alternator; finally this produces emission free energy to power a system of choosing. The fact that this is an off-road vehicle means the pairing of eROT technology and heavy duty off-roading shock absorber is an ideal combination, as the system feeds off the use of the suspension, resulting in the rougher the terrain the more the shock absorber is in motion and producing kinetic and thermal energy being converted to clean electricity.



(Above: a diagram exhibiting Audi's eROT suspension)

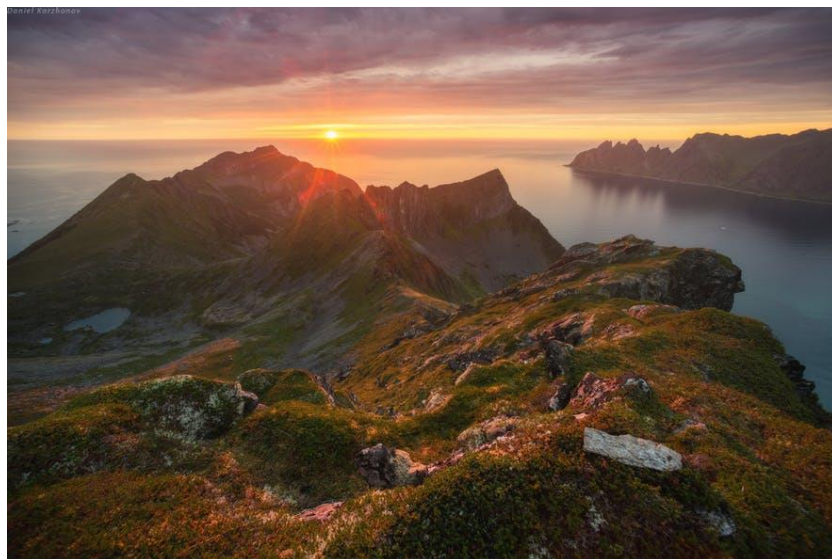
Current production skidoos are generally manufactured using aluminium alloy frames joined together with rivets. Covering the frame are body panels composed of fibreglass or lightweight moulded plastic. The moderate scale method of production and materials used create an affordable and reliable build. In turn, my concept vehicle is host to a variety of innovative and interesting materials with diverse, but appropriate characteristics. Like skidoos, my concept vehicle will be based on an aluminium alloy chassis. This material's qualities of lightness, durability and the ability to withstand temperatures of down to -45 C, mean it is a far more suitable option than another metal such as stainless steel, which isn't recommended for use below -20 C due to the risks of embrittlement and cracks (*Metals and materials for low temperatures and cryogenic applications*). Inside the cabin, all main controls, the centre console and dashboard are made of a resin, suitable to form large plastic surfaces or pieces, which is extracted from recycled materials. I have avoided using impact resistant plastics for the body panels, as they are temperature dependant and can shatter in the cold. One possible alternative is carbon, which holds its qualities down to -100 C, more than sufficient for enduring Norway's icy weather, which has a recorded all-time low of -51 C. The combination of carbon with titanium, creates a composite material called Carbotanium. Invented by Modena Design for Pagani, Carbotanium comprises of titanium and carbon composites bonded together following abrasion of the titanium resulting in a coat. It is then allowed to age, a primer is applied, followed by adhesive and carbon over that, which forms a secure bond between the titanium and carbon composites. The result is a material that has enhanced stiffness, strength and better fatigue properties (*Carbotanium, C.Pouke*). Carbotanium, although an ideal material to form the bodywork and external panels of my design, is incredibly expensive, and the traditional use of fibreglass is a more realistic mass market option. Fibreglass provides durability, but loses in stiffness and strength compared to the superior alternative competitor. My plan would be to have a range of higher specification vehicles available to be tailored to a client's request, including the types of materials used, colour etc. This would be chosen from a set catalogue ranging in price dependant on the differing quality and performances of the materials, with Carbotanium at the top of this list. A basic model could be mass produced using the cheaper material options.

Soy oil is an alternate source to produce rubber sealing, an important aspect of my vehicle as in the extreme climate experienced in the targeted area it is essential all moisture and water is kept out of the interior. In 2009, Coca Cola and Ford launched a project together to create a car seat out of recycled plastic bottles. The resultant material was featured in the Ford Fusion Energi, with the "fabric covering for seat cushions, head restraints and more made with Coke's PlantBottle Technology." (*Coca-Cola and Ford take PlantBottle technology beyond packaging, J.Moyes*). The window glass for my design will come in the form of electrochromic glass, which has the ability to alternate between transparent and opaque. This feature will prove useful in the 24 hour daylight summers experienced in the Arctic Circle, for herders attempting to sleep when the glass turns opaque, blocking external light from the cabin. Located in the air space in double glazed

panes, electrically triggered lithium ions can be switched between electrodes and conductors to alter the amount of light travelling through the window. (*"Smart" windows (electrochromic glass), C.Woodford*).

The harsh and diverse environment of the northern tips of Norway poses many challenges to those simply attempting to travel over it, including the differing terrain, weather and sometimes complete lack of daylight (or darkness). My concept vehicle will be available with two optional packages aimed at overcoming the obstacles presented by the local environment in different seasons. The packages will consist of a variety of tools and add-ons that owners can use on their vehicle appropriately. The two types are determined by summer and winter, clearly suggesting what environments the gadgetry provided is for.

In summer, an increased number of physical obstacles such as rocks or boulders and tree trunks and their stumps can be present when snow melts. A bull bar protective guard will be available to fit to the front of the vehicle to avoid causing significant damage from these obstacles. Melted snow also leads to deeper water levels in rivers and streams, transforming them into moderate blockades. Without any modification, my concept vehicle would be capable of overcoming this challenge owing to its tyre style and off-road suspension improving its ground clearance level. However, water propelled by the wheels could cause spray and spill onto the vehicle, which can be easily prevented with optional mud guards fitted. Finally, the summer option package will again contribute to the green credentials of my design by offering a solar panel. Much of the northern parts of Scandinavia and Finland are exposed to 24 hours of daylight during the summer, known as the midnight sun. The solar panel will be mounted on the roof to take advantage of the extended sunlight and provide an alternative source of clean, electrical energy. This feature would be worthless during the winter months, as like the summer is engulfed in daylight, the opposite is true in winter with some months seeing nothing but darkness.



(The Midnight Sun in Norway during the summer)

The dedicated extras package for winter, will supply a range of tools and technologies aimed at the particular challenges of the coldest months, in addition to the standard features such as heating and air conditioning. As long hours of darkness are a factor of this time of year, multiple LED light bars to attach to the front of the vehicle for added illumination will be available. A snow plough attachment will be provided in case of extreme drifts or when a particular route needs to be cleared. The advanced traction of my concept vehicle ensures it is more than able to deal with moving or hauling a large volume of snow. A roof rack can be placed over the solar panel roof, which would be unusable during the winter. This added equipment offers increased cargo capacity. Other options include a winch, giving the ability to use the vehicle to assist people, other vehicles or reindeer from problematic situations. Long shifts out on the ranch and journeys across the tundra will require an increased range on the electric motor, therefore a backup battery unit attachment will be offered providing similar extra capability that the solar panel creates during the summer season.

Exploiting the potential of my concept design, I have envisioned alternative versions of my halo car. I have designed an export variant for desert environments. Many of the features of my vehicle specifically designed for snow would perform equally well on sand, these being: the all-wheel drive system; the large surface contact area tyres; the lightweight construction; and lastly the high level of torque offered by the electric power unit countering the loose surface (sand or snow). Modest alterations would be all that is required to suit the alternative market, including: the removal of windows (excluding windscreen) for easier access and lighter overall weight; removed heater unit; redesigned seats with small holes to allow the driver's skin to breathe; and addition of dust protection around all exposed wiring and mechanics. A further possible option is a fresh water tank for longer journeys, particularly if the vehicle is adopted by nomadic desert tribes.

Another alternative use I propose for my concept vehicle is a career in motorsports. The Sámi people have traditionally raced reindeer, and now do the same with skidoos on streets and small field circuits. Their competitions are usually small-scale minor events held locally, while larger official skidoo competitions are organised by non-Sámi businesses and are open to any competitor on a multi-national scale. The local races hosted by Sámi's differ between skidoo and reindeer races. The reindeer may be pulling a sleigh carrying the owner or running a straight sprint without human intervention. Their street races are usually held in small Sámi towns and villages with the local main road or high street being transformed into a drag strip, taped off at the sides and temporarily converted to a two lane race track. My vehicle can be modified to excel at specific types of racing both for Sámi competitions, as well as international events. Modification would involve removing the sleeping compartment and dispatching of any unnecessary parts to ensure a lighter mass and adding focussed racing features such as bucket seats and safety attributes like a roll cage. Another type of motorsport connected with the Scandinavian region is rallying in which the aim is covering a distance of usually challenging terrain in as short a time as possible. The racing inspired version of my model would be suitable to compete in this discipline. Research into the sport, informs that cars competing in the FIA WRC (World Rally Championship) now all have all wheel drive, a feature of my design. The advantage of this feature was discovered by Audi in the late 1970s and their finding were used to develop the famous Quattro system. This would help them go on to dominate the early to mid 1980s WRC scene and prompt their competitors to rush to design a car of a similar calibre. Quattro is now an exclusive option offered with every production Audi and their competitors in the automotive industry have created similar branding for their own four-wheel drive models such as Mercedes Benz's '4Matic' and BMW's 'X-Drive', yet neither has the heritage of Quattro (*Donut Media: AUDI QUATTRO*). Other beneficial characteristics of my design as a potential rally car are: the light weight build which results in easier handling; better power to weight ratio which translates into improved acceleration and braking; and the high torque power unit which gives the driver further acceleration out of corners and up undulations. These are all key qualities of a rally car as races regularly take place on loose gravel surfaces and dirt tracks. Rally stages rarely have long straights where top speed is important, which is why cornering and the braking and accelerating that is part of that process is so significant. The widened tread and surface contact area of my design would prove useful in gaining traction to use the torque, power and brakes, which in turn decreases the risk of spinning or losing control of the car. Just like my halo model, this motorsport version could be adapted to racing in desert regions, a popular terrain for rally competitions. This is an important topic in my opinion as many off-road race cars are based on utility models or SUVs (Sports Utility Vehicles), a market that has significantly increased within the last decade and continues to grow. With many other classes of motorsport having uncertain futures, I believe the trend in the current road car market will be reflected in motorsport and desert races such the Rallye Dakar and the Baja 1000 will grow in interest and popularity. Already this year, Ford have launched a new campaign aimed at conquering the Baja 1000, competing against Formula One world champions like Jenson Button and Toyota have managed to secure a motorsport legend, Fernando Alonso, to compete for them in the next Dakar rally. The investment by these major manufacturers and involvement of notable drivers really shows the rapidly increasing globalisation of this branch of motor racing. Ford has also previously declared their aim to cut their product line up to focus on the production of SUVs and utility vehicles, presenting their idea that this is the class of vehicle and racing that could dominate in the future (*Why Ford isn't crazy for killing off its cars, E.Dyer*). This provides a further stage where I could market and advertise my design, highlighting its sportier, as well as off roading, aspects to appeal to customers internationally.



(Ford Bronco R race prototype returning to garage after being defeated by the Baja1000 E.Hall)

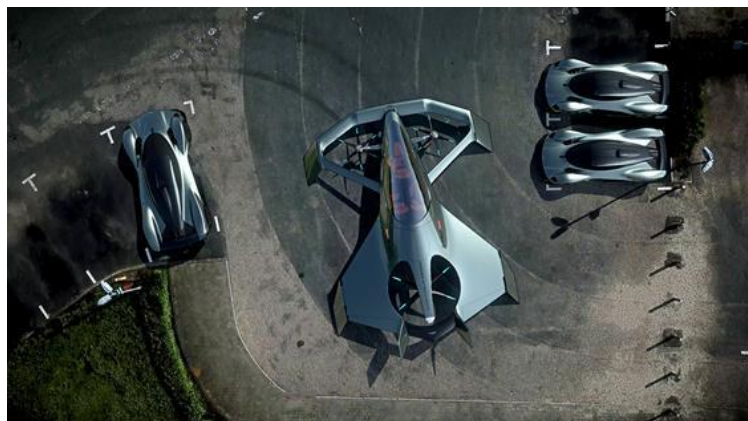
Looking back, at the start of this project I hadn't envisioned a brand that would produce my vehicle. However, mid-way through the design development stage I chose to select three companies to inspire me and aim for a partnership as I felt that there would be a deeper connection and a better fit compared to other contracted manufacturers. I specifically targeted BAE Systems, Ford Motor Company and Aston Martin Lagonda.

BAE Systems are a logical choice as they have a background in military grade vehicles of all types: land, sea and air. The company has had an increase in productivity in recent years and look to have a bright future after launching latest in class models and signing up to multiple contracts all over the world. Even though the brand has some land vehicles in their collection and are working on current concepts of the type, I feel my design could offer them an opening in a more standard civilian market. Similar to how McLaren departed from being an exclusive racing team in 2010, after an extremely brief stint of manufacturing production cars in the early 1990s, they then entered a supercar dominating phase. Throughout this decade McLaren have become the most active supercar manufacturers and not at the cost of quality, but with a nod toward the strong heritage of their racing team they have become successful in a larger, albeit still exclusive, market. I believe that BAE Systems could achieve the same level of success, as they have a solid infrastructure regarding high quality and durable vehicles as a result of being contracted military level projects. My concept provides BAE Systems with their first production stepping stone, just like the MP4-12C did for McLaren to kick start a more commercial success.

I secondly list Ford Motor Company as a potential manufacturer, for a plethora of reasons. To recap and expand on points already mentioned earlier in my essay, Ford have recently announced they are cancelling the production of all but two actual traditional cars and will be focussing on developing new SUVs and utilitarian and trade vehicles. Originally, the main design quality of SUVs was their ability to perform off road, however I would argue this is no longer the case and style and fashion and possibly safety are factors more considered by consumers, but Ford is making an effort to counter this trend with the new Bronco and Ranger Raptor which are more pure utilitarian vehicles. I have also mentioned large off-road rallying events being an important part of the future of motorsports and, by association, the automotive industry. As my concept vehicle is an aspiring rough terrain model with the ability to adapt for rally sports, I can see it would be a good fit for Ford's future production line up.

Finally, Aston Martin Lagonda, a British sports car manufacturer that has a rich history and a bright future. Aston Martin has been in existence for over a century, and has developed a brand that is often regarded as the pinnacle of luxury and performance, whilst making some of the best-looking cars throughout their legacy. In recent years, Aston have created some incredibly exciting concepts in a series of collaborations with partners outside of the industry. This is the part of the Aston Martin brand I believe my vehicle will fit into, alongside with previous projects that have been key inspirations for my project: AM37, Volante Vision, Project Neptune and AMB 001. The first, AM37, was Aston Martin's introduction into the boating industry with

the guidance of Quintessence Yachts. In Aston's own words "The Volante Vision concept is Aston Martin's exploration into personal air mobility" that "previews a flying autonomous hybrid-electric vehicle for urban and inter-city air travel". It was a result of a partnership with Cranfield Aerospace Solutions, Cranfield University and Rolls-Royce. Project Neptune is the result of Aston teamed with Triton Submarines LLC to produce a three-man mini sub aimed at researchers, explorers and super yacht owners. Most recently in early November 2019, they revealed a joint venture with Brough Superior developing a track only limited run motorcycle, AMB 001. Each of these collaborated concepts feature large smooth surfaces hugging a flowing and contemporary form, demonstrating that despite entering new fields, the mood of the classic design they are renowned for has not been compromised. Aston have been intelligent enough to involve industry proven brands before diving into a different strands of vehicle design and manufacture. So, this is why my concept design parades a set of Aston Martin winged badges, as I see it complimenting these previous projects and continuing this exciting narrative of concepts. I wanted to include this segment in my dissertation as I think that brand identity is incredibly important in this current era, where so much is becoming more or less the same, and characterising what makes your products different and better than everyone else's is so important.





(Above images from top down: AM37, Vision Volante, Project Neptune, AMB 001.)

I firmly believe that my concept will succeed in performing exceptionally well at its primary use, supporting the Sámi as they travel alongside their reindeer on their migration across the Arctic Circle. My design is tailor made for the Norwegian electric vehicle infrastructure and the diverse terrain of the northern tundras and fjords on the north coast. On top of this it also appeals globally, with the key advantage of this design being it's potential to be adapted, improved and exported to success. My concept will be a cornerstone in the future of Sámi reindeer herding, global exploration and motorsports. I hope this enables you to understand and start to see my vision.

By Sean Deacon

Bibliography:

Photograph of the Arctic Cathedral/ Tromsdalen Church:

<https://travelguide.michelin.com/europe/norway/troms/tromso/arctic-cathedral>

Reindeer herding in Norway by Jennifer Foster:

<https://www.laits.utexas.edu/sami/diehtu/siida/herding/herding-nr.htm>

Norway is leading EV owning country in the world; an article for Shell New Motion:

<https://newmotion.com/en/norway-is-leading-ev-owning-country-in-the-world>

Why little Norway leads the world in EV usage by David Nikel:

<https://www.forbes.com/sites/davidnikel/2019/06/18/electric-cars-why-little-norway-leads-the-world-in-ev-usage/#3f4a275613e3>

Military specialist and Tank historian Nick Moran's YouTube channel:

<https://www.youtube.com/user/TheChieftainWoT>

Michelin develops new airless tyre by Jordan Golson for Auto Express:

<https://www.autoexpress.co.uk/car-news/107070/michelin-develops-new-airless-tyre>

Here's how Audi's new technology harnesses suspension movement to boost MPG by David Tracey:

<https://jalopnik.com/heres-how-audis-new-technology-harnesses-suspension-mov-1785122614>

Audi's eROT suspension diagram:

<https://newatlas.com/audi-erot-electrical-suspension/44848/>

How It's Made Episode 407 Snowmobiles:

<https://www.youtube.com/watch?v=jf8fm5NpFE4>

Driving Innovation: Coca-Cola and Ford take PlantBottle technology beyond packaging by Jay Moyer:

<https://www.coca-colacompany.com/stories/driving-innovation-coca-cola-and-ford-take-plantbottle-technology-beyond-packaging>

"Smart" windows (electrochromic glass) by Chris Woodford:

<https://www.explainthatstuff.com/electrochromic-windows.html>

Metals and materials for low temperature and cryogenic applications:

<https://www.gasparini.com/en/blog/metals-and-materials-for-low-temperatures/>

Carbotanium by Christof van Poucke:

<https://carbonfibermonocoque.wordpress.com/2014/03/10/carbotanium/>

Midnight Sun in Norway image:

<https://norwaytravelguide.no/norwegian-nature/midnight-sun-norway>

Donut Media: AUDI QUATTRO- Everything You Need To Know/ Up To Speed:

<https://www.youtube.com/watch?v=IWOBbV4-9TY>

Why Ford isn't crazy for killing off its cars by Ezra Dyer for Popular Mechanics:

<https://www.popularmechanics.com/cars/car-technology/a20076013/ford-sedans-fusion-focus-canceled/>

Ford Bronco R race prototype image Emme Hall 27/11/19:

<https://www.cnet.com/roadshow/news/ford-bronco-r-baja-1000/>

Aston Martin AM37:

<https://www2.astonmartin.com/en/am37>

Aston Martin Volante Vision:

<https://www.astonmartin.com/en-gb/models/future-models/the-aston-martin-volante-vision-concept-2019>

Aston Martin Project Neptune:

<https://www2.astonmartin.com/en/project-neptune>

Aston Martin AMB 001:

<https://media.astonmartin.com/the-amb-001-by-aston-martin-and-brough-superior/>