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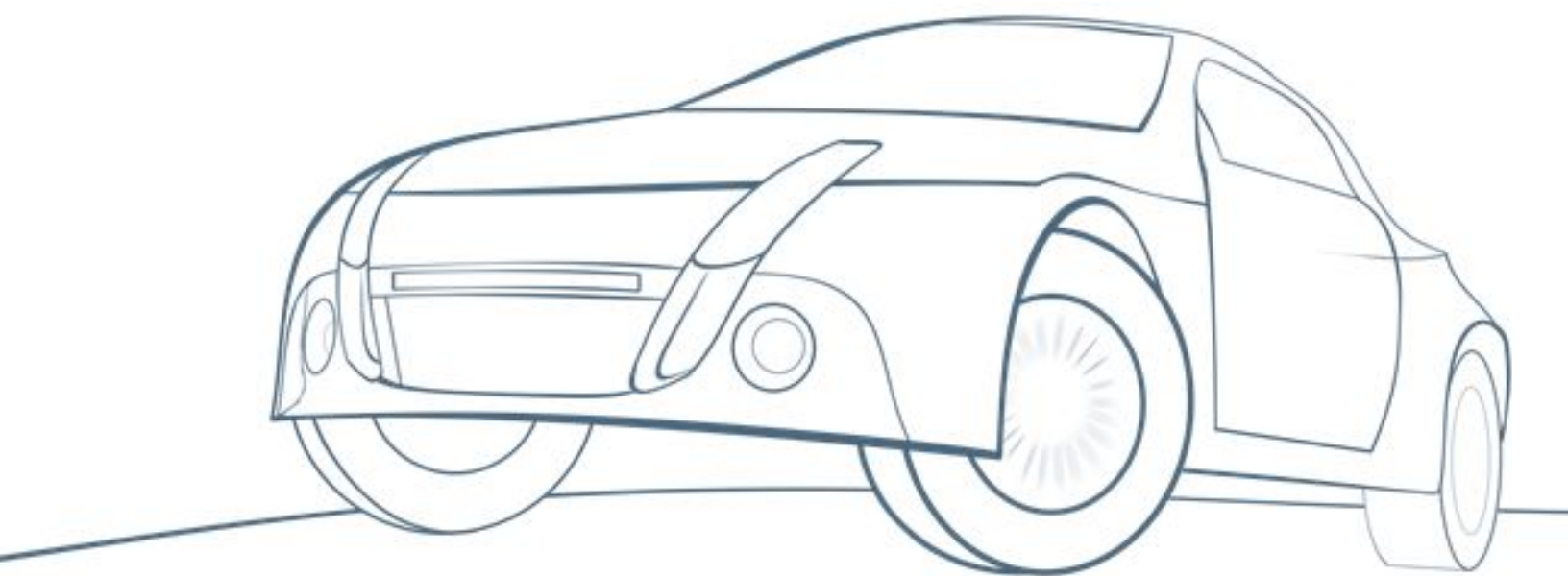
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2030 Internal Combustion Ban:

Keeping enthusiast motor vehicles alive in the face of anti-internal combustion legislation and increasing autonomy.

2483 Words (Exc. Bibliography)



2030 Internal Combustion Ban:

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Rationale & Research:

For many years now, both motoring journalists and petrol heads alike have shared a concern that alternative fuel and autonomy will bring an end to the enthusiast motor vehicle (Everly, 2017). Whilst I agree that the current market availability of alternative fuel sports cars suggests that this will be the case (Car Buyer, 2020), it does not have to be.

An affordable, engaging, sporty electric (or hydrogen) car could play a major role in positively influencing public opinion of alternative fuel vehicles. However, there are not currently any vehicles that fill this particular niche. Some manufacturers have attempted to, such as Detroit Electric. However, their success has not been measurable in any positive manner, with extremely limited production numbers (Green Car Reports, 2015). Other manufacturers did announce plans to produce electrified versions of their entry level sports cars (TheSupercarBlog, 2019), but none have reached testing or have since morphed into yet more bland cross-overs (Autoexpress, 2019).

Unfortunately, it is not just powertrain changes and lack of exciting design that threaten the enthusiast car, but also autonomy (Bloomberg, 2017). As autonomous driving becomes the norm, it will eventually threaten the legality and existence of driver controlled vehicles (Ross, 2014). If autonomy were to eventually become safe enough to pilot the majority of vehicles on the road (BBC, 2020), the enthusiast market would suffer greatly. Additionally, the complete abolishment of manual controls could potentially lead to more accidents due to autonomy failures (Slashgear, 2019). By allowing drivers the option to take command and providing the controls to do so in the event of an emergency or failure, public perception would not only be improved, but consumers would also be encouraged to purchase a safer vehicle (Slashgear, 2019).

Whilst some petrol heads have taken the plunge, many have found that the infrastructure for electric vehicles is still substandard. Whilst Tesla has poured significant resources into ensuring a more user-friendly experience (CAR Magazine, 2020), other companies have relied on the existing, government backed, charging network (Forbes, 2020). This widely available charging network is poorly maintained, unreliable and provides nothing like the capacity required to meet demand (The Guardian, 2020). However, this is an issue that the government will be under increasing pressure to rectify, as their 2030 law change (The Guardian, 2020) means that the infrastructure must be available if the public are to make the switch. Attempting to tackle such an issue outright in my own design would not be feasible due to the eco-political nature of the inevitable solution. It is clearly not a problem that design alone can solve.

Instead, tackling the image of electric power may perhaps be better done through the mode of motorsport. Racing has long proven to be a significant player in advancing automotive technologies, both in terms of performance and safety (WhichCar, 2017). From carbon fibre to rear view mirrors (Roach, 2020), motorsport has allowed for developments in vehicles that may not have been pursued for decades or discovered at all (at least in the context of cars). Using motorsport to further the development of alternative fuel vehicles will undoubtedly accelerate innovation and development. Whilst Formula E is currently carrying the flame, World RallyCross is set to follow with an Electric class, 'Projekt E' (WTF1, 2019) as well as a junior single make Rally Championship - The ADAC Opel e-Rally Cup (Autocar, 2019). Independent development of an electric rallycross car culminated in 2016 with the highly successful debut of the first competition ready electric rallycross car (Ridge, 2016). However, there are currently no plans to fully electrify the pinnacles of world motorsport - Formula 1 (Autosport, 2019) and the WRC (Top Gear, 2019). With the advent of safer battery technology and the use of non-flammable graphene cells (Chhantyal, 2020), electrified motorsport is becoming a safe distinctively more modern option.

Initial Ideation:

Initially, my first instinct was to research and create an electric light sports car for mass production. Its aim would be to provide an appealing alternative fuel car to enthusiasts who crave a more engaging driving experience at a lower price point. Currently, there are no options at the £30,000-£60,000 price point to satisfy this niche (Car Buyer, 2020). However, reflecting on this idea, I came to the conclusion that it is something that larger manufacturers will already be internally pursuing as the 2030 ICE ban looms ever closer (Motor Authority, 2020).

After my first instinctive idea, I decided to look further into the future. A future where autonomy will undoubtedly threaten the human-machine dichotomy of the motoring experience (Ross, 2014). My idea - simple: an autonomous sports personal vehicle, which is controllable on command. Drawing inspiration from a range of sources, particularly those from popular culture (e.g. iRobot), I dreamt up a sleek form of personal transport that conveys wealth but that also allows the user to control it themselves at the push of a button (Slashgear, 2019). Upon further research and consideration, however, I began to feel that this particular idea was not original enough to produce an interesting final design.

Finally, I closed in on motorsport. Whilst there are attempts to popularise alternative fuels and autonomy in motor racing, such as RoboRace (Scott, 2019), none have properly captured the imagination of the public. In order for the public perception of alternative fuels to shift to an overall more positive one, there must be a demonstration of just what can be done. Whilst the VW I.D. R (Top Gear, 2018) certainly fits the bill, the more limited audience for the Pikes Peak hill climb limited its reach. Pikes Peak achieved an estimated 544,000 live viewers, compared to the 1.9 billion strong worldwide audience of Formula 1 (AdTargeting, 2020) (Formula 1, 2020). Whilst Formula e is more easily accessible to the public, it is still perceived as somewhat of a gimmick by many (Medium, 2018). Motorsport is in the best position to capture the imagination of the public when it is both at its most competitive and technically advanced. The best example

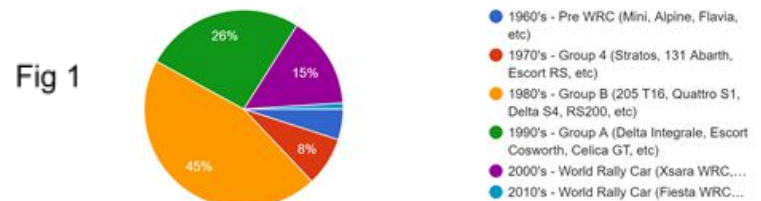
of this is the Group B era of the WRC (Aldridge, 2020). Bringing motorsport back to public television and providing easily accessible free coverage (e.g. availability on YouTube and other streaming services) would result in significantly increased viewership and increase its influence on consumers (The Conversation, 2017).

Final Idea:

My final idea is to create an electric WRC car for the 2030 season. I propose an overhaul to the rules and broadcast structure in order to create a more accessible, impactful and influential motorsport that will not only help sway the public perception of alternative fuel technologies, but will also help to keep enthusiast vehicles alive in an increasingly environmentally and safety conscious industry. By utilising a sport which is renowned for its excitement and perceived danger, the imagination of the public can be captured more easily and swinging the perception of alternative fuel in a positive manner could prove vital for its expedient success.

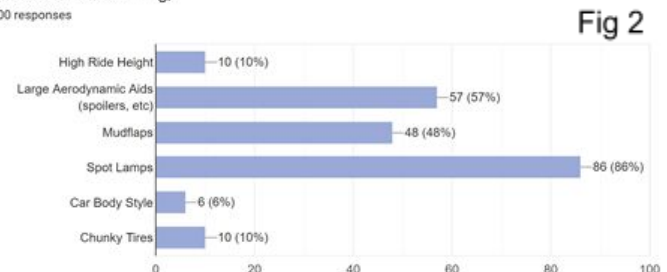
The vehicle will be a low volume production affair, with a factory team and privateer units made to order. With my proposed rule change, 250 road going variants would have to be produced in order to satisfy the homologation requirement. A stark reduction compared to the current requirement of 2500 (FIA, 2020). By reducing the requirements placed on the manufacturer, it is my hope to reignite the innovation that Group B had brought about in WRC's most memorable and iconic era (Aldridge, 2020) (Fig 1).

Which era of Rally racing is most memorable and iconic? (Select One)
100 responses



During my initial research, I was taken with the snake-like design of the Colin McRae R4. As a result, I decided to look to nature in order to take inspiration for the agile, muscular and aggressive style that rally cars so often portray. Both in aesthetics and performance. My aim is to aesthetically bring a return to the Group B (and stillborn Group S) era, with unique supercars that race off road, rather than production subcompacts modified to rally. Unlike Group B, however, safety will be a significant concern (Top Gear, 2013). I aim to maintain the design lineage and characteristics of the sport as it progresses into the future. As a result of the survey that I conducted - I have successfully identified spot lamps and aggressive aerodynamic aids as the two main defining visual characteristics of a rally car (aside from a racing livery) (Aldridge, 2020) (Fig 2).

What are the defining visual characteristics of a Rally car, across the sports history? (Select all that you believe are defining)
100 responses



Primarily dictated by the technical packaging and aerodynamic function, the aesthetics will take on a somewhat spartan appearance. The size and proportions will be similar to that of a 'supermini' (Euro B Segment). This will mean that it will be somewhat diminutive. However,

thanks to the flexibility of the electric powertrain, it will still be possible to achieve significant space within the cabin. Short wheelbase cars have proven to be extremely successful throughout the history of the WRC, from the Lancia Stratos to the city car based machines of today (Autoexpress, 2018).

Rather than opt for the traditional hatchback design, however, I have selected a low-slung coupe roof line, with the rear of the car flowing smoothly upwards to the roof. This profile is comparable to the Nissan 350Z or Porsche 911: it gives a significantly more exotic

Fig 3



appearance than the current rally cars (Fig 3). It is also much more in keeping with the 'inspired by nature' approach that I have taken, bearing resemblance to the head of a snake and how it flows into the rest of its body without interruption.

Furthermore, ensuring that the design has a wide and imposing stance is something that I believe to be an important characteristic of a race car. Using the thigh muscle structure of animals such as the cheetah and jaguar as inspiration, I incorporated this into my initial design sketch (Fig 4). I also followed my initial inspiration of the snake head and fangs to create a striking front end and flowing silhouette, broken only by the adaptive rear wing (Fig 4).

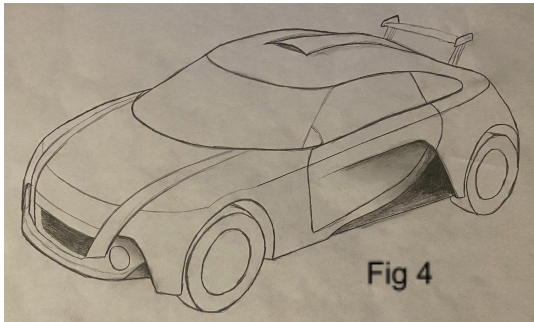


Fig 4

Mechanical considerations also have to be made in order to create a successful design. For example, the environment in which the vehicle will be used is not fixed. It must be able to adapt to frigid Nordic winters and scorching Australian summers in equal measure. The vehicle will have to make use of a heating/cooling system to ensure that the battery's performance does not deteriorate in extreme temperatures.

The chassis of the vehicle will take inspiration from those found in Tesla models, known as a 'Skateboard Chassis'. This design allows for the battery cells to be kept low to the ground, but also within the survival cell of the vehicle, shielding them from impact (Abuelsamid, 2016). However, in my design, the batteries will be afforded extra underside protection and sit within the roll cage of the competition variant - preventing potentially devastating deformation of the battery pack (The Drive, 2020). The battery pack will also be easily removed by mechanics in service areas, allowing

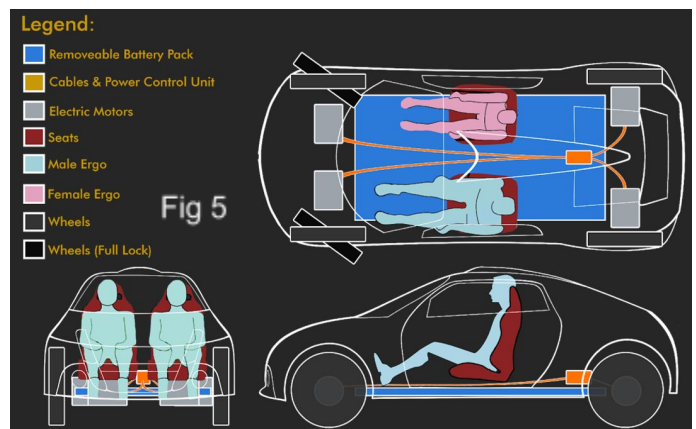


Fig 5

for a full battery replacement in the event of a lack of charge time or component failure. This system will be comparable to that of the NIO EP9, though unlike the NIO, the batteries can be charged in-situ and will be lowered from the underside of the car rather than slid out from the side (The Grand Tour, 2019). This can be seen in my preliminary package drawing (Fig 5).

Conclusion & Product Design Specification:

In conclusion, I settled on my final proposal as I feel that it sufficiently solves the issue of the enthusiast motor vehicle dying in the face of anti-internal combustion legislation and increasing autonomy. Additionally, by reinvigorating and electrifying the WRC, it not only modernises the sport, but also will help to expedite the development of safer and more efficient battery technology, such as non-flammable graphene battery packs (Chhantyal, 2020). Furthermore, the extreme nature of rallying as a sport allows wild design and engineering. This is something that I hope to embrace with the proposed return to low volume homologation.

In order to ensure that the final product is fit for the purpose originally outlined, I have created the following design specification that it must adhere to in order to fulfil its objective.

Parameter:	Description:
<i>Target Customer</i>	Privateer Rally teams - for drivers looking to compete at the highest levels of the WRC.
<i>Aesthetics</i>	Primarily dictated by the technical packaging and aerodynamic function. Design should be aggressive but functional.
<i>Ergonomics</i>	The car must be able to comfortably and safely accommodate the driver, co-driver, mandatory spare wheel(s) and roll cage. Seats and steering wheel, however, must conform to FIA standards. These items are usually standard issue and must be designed around.
<i>Size</i>	The platform of the vehicle must fit within the Euro B Segment standard.
<i>Performance</i>	The car should have in excess of 350 HP in order to remain competitive and must be full time all-wheel drive, though power distribution can be variable and computer controlled. The setup of the vehicle must focus on acceleration rather than top speed.

<i>Environment</i>	The car must perform to its full potential in all environments that the WRC competes in. From the Safari Rally in Kenya to the freezing snow of Rally Sweden, the car must be reliable and consistent.
<i>Production Quantity</i>	The car must have 250 road going variants produced in order to meet the proposed homologation requirements. The competition variant must have 4 units produced for the factory team. Any other units are to be built to order from privateers and general consumers seeking to add a competition car to their garage.
<i>Manufacturing Properties</i>	The chassis of the vehicle must be quickly and cheaply replicated so that it can be replaced in the event of a catastrophic crash. More complex aerodynamic and body parts can use more complex handmade techniques in order to keep tooling costs down.
<i>Materials Properties</i>	The materials used in the construction of the car must sufficiently protect both the occupants and fuel source in the event of a crash, regardless of severity. Materials should be selected on their strength and performance. Exotic materials are permitted, as long as they appear in the homologation model.
<i>Target Product Cost</i>	ICE WRC cars have a price tag of £500,000. Given the experimental nature of some electric powertrains, prices between £500,000 and £700,000 are acceptable. The cost of the homologation special should be significantly lower than that of the competition model, with a maximum of £250,000.
<i>Launch Date</i>	The launch date for the car is 2030, to align with the start of the 2030 WRC season.
<i>Sustainability</i>	The power source and production of the car should be as sustainable as possible in order to mitigate the damage caused to the environment by the production of the battery cells. Recycled materials should be used where possible, as well as ensuring that parts can be recycled.

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Images: -

Image on front cover: Aldridge, M (11th November 2020) *WRC-e Digital Outline Sketch*

Fig 1:

<https://docs.google.com/forms/d/e/1FAIpQLSeRg8AbIjQ0GF0IVzkOjT3KaqbQnhRWdgJWYO5GM3aBAHffEw/viewanalytics>
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Fig 2:

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Fig 3: <https://lezebre.lu/images/detailed/84/48653-Sticker-Porsche-911-Silhouette.png> (Accessed on 10/12/20, 15:34)

Fig 4: Aldridge, M (20th November 2020) *WRC-e Final Design (Early Development Version)*

Fig 5: Aldridge, M (18th November 2020) *WRC-e Preliminary Package Drawing*