HYPER CAR

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ABSTRACT

Design and making cars in a different way emphasize ultra light weight, ultralow drag, and integrated design can reduce required propulsive power by about 2-3. This can make direct-hydrogen fuel cells and commercially available compressed-hydrogen-gas tanks practical and reasonable even at relatively more early prices. Coordinating such vehicles with deployment of fuel cells in buildings permit to a rapid transition to a non polluted environment hydrogen economy that is profitable at every step starting now. New manufacturing and design methods can also make these radically more efficient vehicles cost-competitive & uncompromised, as calculated by a 2.38-litre-equivalent-per-100-km midsize sport-utility concept car designed in the year 2000 by Hyper car, Inc. Major reductions in the required capital, assembly, space, and product cycle period can offer key competitive advantages to early adopters. These changes are increasingly recognized as portents of unprecedented technical and market transitions that can make cars non polluted environment and the car and oil industries more benign and profitable

Keywords: design integration, hydrogen, hyper car, light weighting, mass decompounding, ultra light, vehicle efficiency, whole-system design.

I. INTRODUCTION

The global automotive industry is arguably the largest and most complex undertaking in a industrial history. Its myriad highly evolved production platforms meet with remarkable skill the conflicting demands of cost, safety, performance, reliability, emissions, and market appeal. However, in a world where cars multiply twice as fast as people, such escalating concerns as climate protection and energysecurity are becoming hard to address with vehicles that, despite a century'sengineering effort, use only one percent of their fuel energy to move the driver.Traditionally, automakers and policymakers have presumed that major gains infuel economy or carbon emissions can come only from government mandate orhigher fuel price. In the US, these interventions favored respectively by oil and carcompanies have attracted titanic lobbying efforts and fought each other to a drawfor two decades. Even in the European Union, with its more coherent approach topublic needs, policy is buffeted by random and increasingly volatile oil prices andpotential supply disruptions. Most developing countries, except perhaps for theeople's Republic of China, have subordinated fuel-economy and environmentalconcerns to their desire to build car industries and buy cars.Both automakers and policymakers have adopted from economic theory theassumption that any major improvement in fuel economy or carbon emissionsmust be traded off against size, comfort, performance, cost, or safety ± requiring,in turn, government intervention (such as mandate or subsidy) to inducecustomers to buy the compromised vehicles. The unattractiveness of thatpresumed compromise underlies US automakers' lobbying and litigation positions,which inadvertently unmarked their own impressive innovations in more efficient,cleaner, but safe and attractive vehicles. In the absence of effective US nationalpolicy, disparate state-level policies are emerging, starting in California, and will vexsuppliers.Against this background of increasing inconsistency between public-policy andcommercial goals, auto making is exhibiting all the signs of a classic over matureindustry: hyper competition over shrinking niches for convergent products insaturated core markets, global overcapacity and consolidation, cutthroat commodity pricing, modest to negative margins, stagnant basic innovation (until the mid-1990s),and limited attractiveness for recruiting top talent or strategic investment. In short,automaking, like airlines, is a great but challenged industry, ripe for fundamental change. Other industries are examining this opportunity. At the 1999 Paris Auto Show, MIT analyst Prof Daniel Roos warned the assembled CEOs that in the next decade or two, quite a few of them would be put out of business often by firms theydon't now consider their competitors. Since 1990±91, a small independent development effort has been challenging theconventional approach to automating, at first from outside and lately from insidethe auto industry. It is based on premises that at first seemed implausibly radical, but have withstood a decade's scrutiny and increasingly define the industry's emerging strategy.

- Very large improvements in fuel economy and carbon emissions may be easier and cheaper than small ones, and may be achievable simultaneously without compromising existing goals.Such improvements may also bring decisive competitive advantage to early adopting manufacturers by reducing requirements for capital, assembly, space, parts, and product cycle time.
- This could permit a robust business model based on value to customers and advantage to manufacturers not on fuel price, government policy, or other random variables.
- The resulting vehicles may also facilitate advantageous shifts in fuel infrastructure that meet climate and security goals at costs comparable to or lower than today's and permit a smooth and profitable transition from today's asset base.
- Achieving these ambitious goals requires leadership rather than a regulatory-compliance mindset, and a complete change in how cars are designed and built a technological and institutional change as striking as those that began to shapetoday's auto industry nearly a century ago.In this view, now becoming obvious to many in the industry, technologicalchange will not be smooth and incremental but discontinuous and radical.Astonishing advances in fuel economy and carbon emissions will be less the effectsof regulation or fuel price than the emergent byproducts of breakthroughengineering. Rather than requiring governmental inducements to buy costlier orless attractive vehicles, customers will prefer the new versions because they will offersuperior attributes at comparable cost. And to achieve this breakthrough,automakers would focus less on lobbying, litigation, and public relations than onengineering.

This article summarizes how these goals can be achieved, progress so far inachieving them, and the prospects of accelerating their realization.

II. VEHICLE DESIGN PRINCIPLES

Hypercar, Inc. has developed a set of fundamental design principles for any vehicletype:

2.1. Start from a clean sheet

Incremental product refinement is an important part of engineering. In the autoindustry, it has yielded high quality and value, expanding features, and efficientproduction. However, when seeking major improvements in performance (accelera-tion, handling, fuel economy, emissions, or any other measure), or such fundamentalchanges as switching from internal combustion to fuel cells, incrementalism can leadto compromised vehicles, poor sales, or even failure.

2.2. Define clear and complete product requirements

The foundation of clean-sheet design is defining clear product requirements(including cost) in terms of ends, not means, so that ambitious requirements aretechnology-forcing but technology-neutral. Normal, incremental automotive development assumes an `incumbent' vehicle and specific desired improvements, so itlimits the solution space. Clean-sheet design instead allows anything within theconstraints of the product requirements. Like writing a new document from scratchinstead of editing an old one, clean-sheet design is both more challenging and moreliberating , if the goal is clearly defined. Goal statements must also distinguishbetween essential and merely desirable.

2.3 Design as a whole system

Whole-system design goes hand-in-hand with clean-sheet design, but they'redifferent. Clean-sheet design is a starting point, while whole-system design is themethod of the journey. Whole-system design focuses the development team onmeeting vehicle-level targets. Although each team member can be responsible for asystem, and each system has its own flexible secondary goals, the primaryaccountability of each team member is for vehicle-level performance.

2.4 Strongly emphasize platform lightweighting and efficiency.

Only a small fraction of a vehicle's fuel energy ends up moving the passengers andcargo and powering vehicle systems. Most of the fuel energy ends up as heat throughthermodynamic losses, mechanical friction in the driveline, rolling resistance,aerodynamic drag, braking, and electrical system inefficiencies. Many studieshave concluded that fuel economy is most sensitive to engine and driveline efficiency,and much less sensitive to mass.

III. REVOLUTION CONCEPT CAR DESIGN

The Revolution fuel-cell concept vehicle was developed byHypercar,Inc. in 2000 todemonstrate thetechnical feasibility and societal, consumer, and competitive benefitsof holistic vehicle design focused on efficiency and lightweighting. It was designed tohave breakthrough fuel economy and emissions, meet US and European MotorVehicle Safety Standards, and meet a rigorous and complete set of productrequirements for a sporty five-passenger SUV crossover vehicle market segment withtechnologies that could be in volume production within five years (Figure 1).The Revolution combines lightweight, aerodynamic, and electrically and thermally efficient design with a hybridized fuel-cell propulsion system.

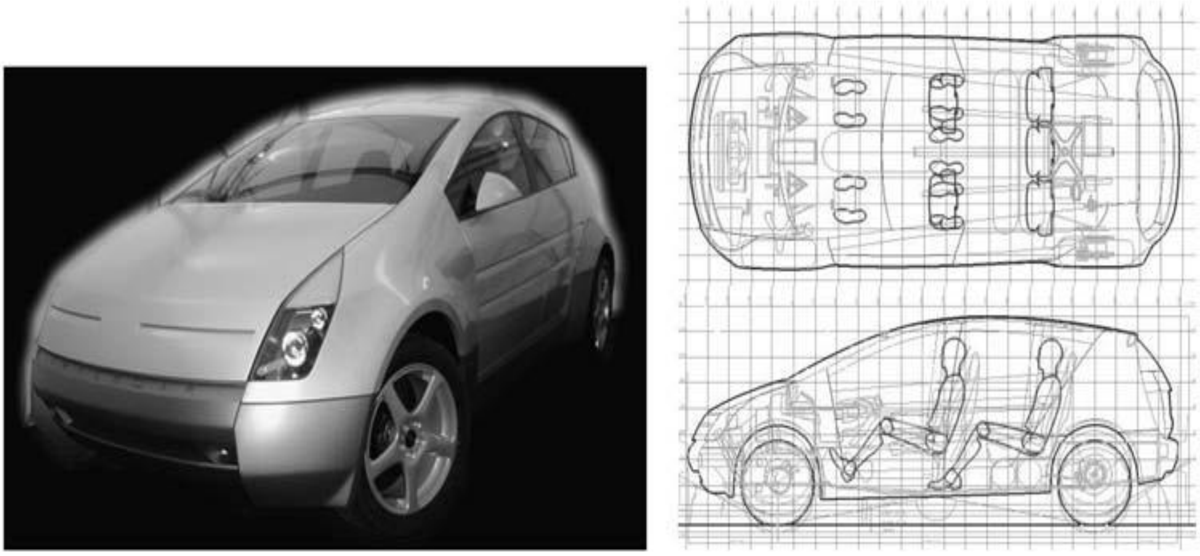

Figure 1 Revolution concept car photo and package layout

- Seats five adults in comfort, with a package similar to the Lexus RX-300
- 2.38 L/100kmequivalent, using a direct-hydrogen fuel cell, and simulated for realistic US driving behavior
- 530-km range on 3.4 kg of hydrogen stored in commercially available 345-bar tanks.
- Accelerates 0±100 km/h in 8.3 seconds
- All-wheel drive with digital traction and vehicle stability control
- Modular electronics and software architecture and customizable user interface
- Potential for the sticker price to be competitive with the Lexus RX-300, Mercedes M320, and BMW X5 3.0, with significantly lower lifecycle cost.

3.1 Lightweight design

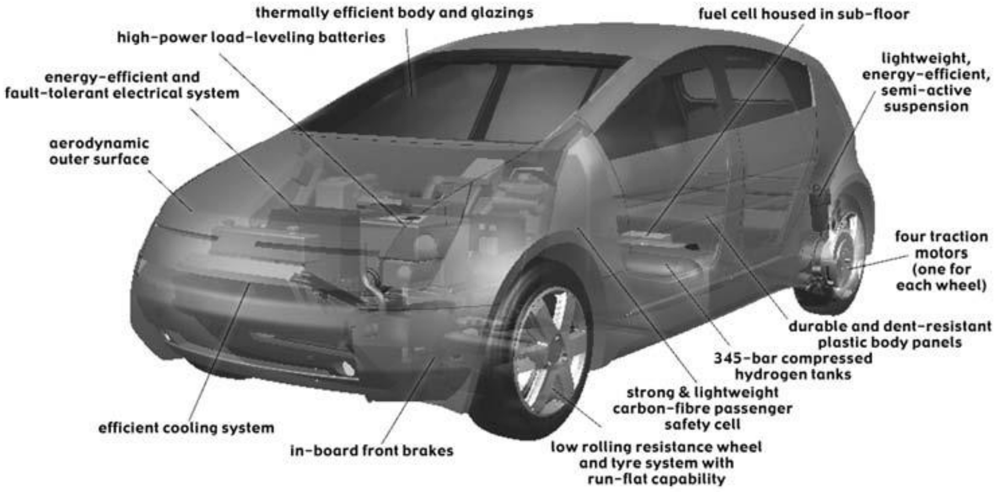

Figure 2 Key design features of the Revolution

Every system within the Revolution is significantly lighter than conventional systems (as shown in table1)to achieve an overall mass saving of 52%. Techniques used tominimize mass, discussed below, include integration, parts consolidation, andappropriate application of new technology and lightweight materials. No single system or materials substitution could have achieved such overall mass savingwithout strong whole-car design integration. Many new engineering issues arise with such a lightweight yet large vehicle. Whilenone are showstoppers, many required new solutions that were not obvious anddemanded a return to engineering fundamentals. For example, conventional wheeland tire systems are engineered with the assumption that large means heavy. The lowmass, large size, and high payload range relative to vehicle mass put unprecedenteddemands on the wheel/tyre system. Hypercar, Inc. collaborated with Michelin todesign a solution that would meet these novel targets for traction and handling,design appeal, mass, and rolling resistance.Another challenge in this unusual design space is vehicle dynamics with a grossmass to kerb mass ratio around 1.5. Tomaintain consistent and predictable car-like driving behaviour required an adaptivesuspension. Most commercially available versions are heavy, energy-hungry, andcostly. Hypercar, Inc. collaborated with Advanced Motion Technology, Inc.(Ashton, MD) to design a lightweight semi-active suspension system that couldprovide variable ride height, load leveling, spring rate, and damping withoutconsuming excessive amounts of energy. Other unique challenges addressed includedcrosswind stability, crashworthiness, sprung-to-unstrung mass ratio, and acoustics.

System	Benchmark mass (kg)	Revolution mass (kg)	Difference (%)
Structure	430	186.5	57%
Propulsion	468	288.3	38%
Chassis	306	201.2	34%
Electrical	72	33.4	54%
Trim	513	143.2	72%
Fluids	11	4.1	63%
Total	1800	856.6	52%

Table1 Mass comparison of Revolution with a conventional benchmark vehicle

IV. FUELS USED IN HYPER CAR

Hyper car vehicles could be designed to run on almost any type of fuel—liquid or gaseous, renewable or Non-renewable. Although emissions depend on fuel choice, the Hypercar® platform would be so efficient to begin with that it would be much less polluting than a conventional car even if it used standard gasoline or diesel. Hypercar vehicles' high fuel-to-traction efficiency would also make cleaner gaseous fuels (such as methane) more feasible, because smaller, lighter, and cheaper storage tanks could be used without Compromising range. (The same reasons would make hydrogen an attractive Hypercar fuel, especially if Converted to electricity via an onboard fuel cell—see the next answer.) Many factors are likely to influence which fuels are used in Hypercar vehicles, including fuel price, Market preference, fuel distribution and refueling infrastructure, and public policy. In Europe, for instance, early Hypercar vehicles might be powered by small diesel engines, since

European automakers are very good at building relatively clean diesels. In the United States, compressed natural gas or unleaded gasoline engines might be preferred in the near term. But in the medium to long term, hydrogen looks like the most promising fuel for ypercar vehicles because it produces very low to no emissions and can be made using renewable energy. More on this in the next answer.

V. ADVANTAGES

Here are few of the top advantages of having a hyper car:-

1. Environmentally Friendly: One of the biggest advantage of hyper car over gasoline powered car is that it runs cleaner and has better gas mileage which makes it environmentally friendly. A hyper vehicle runs on twin powered engine (gasoline engine and electric motor) that cuts fuel consumption and conserves energy.

2. Financial Benefits: Hyper cars are supported by many credits and incentives that help to make them affordable. Lower annual tax bills and exemption from congestion charges comes in the form of less amount of money spent on the fuel.

3. Less Dependance on Fossil Fuels: A Hyper car is much cleaner and requires less fuel to run which means less emissions and less dependance on fossil fuels. This in turn also helps to reduce the price of gasoline in domestic market.

4. Regenerative Braking System: Each time you apply brake while driving a hyper vehicle helps you to recharge your battery a little. An internal mechanism kicks in that captures the energy released and uses it to charge the battery which in turn eliminates the amount of time and need for stopping to recharge the battery periodically.

5. Built From Light Materials: Hyper vehicles are made up of lighter materials which means less energy is required to run. The engine is also smaller and lighter which also saves much energy.

VI. DISADVANTAGE

Expensive: The biggest drawback of having a hyper car is that it can burn a hole in your pocket. Hyper cars are comparatively expensive than a regular petrol car and can cost $5000 to $10000 more than a standard version. However, that extra amount can be offset with lower running cost and tax exemptions.

VII. CONCLUSION

Hence we have studied hyper car in details. And have concluded that, according to its advantages hyper car is very useful in todays life. Since in hyper car the modern composite materials are used it's weight has been reduced upto 52% than conventional car, that's why the efficiency of the car is increases. Hence by using hyper car we can achieve our goals towards green environment also.

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