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SHIFT 09

Lightning Car Company

Arthur Wolstenholme F.M.M.

Technical Director & Co Founder Lightning Car Company 2008

Managing Director & Founder Vanwall Cars 2004

Managing Director & Founder Ronart Cars 1984 - 2003



Performance Sports Cars 2006

- Last 25 years used to designing cars with high performance engines ranging from 2.2 litre to V12 6.3 litres
- Automotive world starting to be influenced by climate change opinion
- Had to find an alternative
- Painting the green dipstick handle was not what was meant by going green !

Hydrogen ? Hummmm
CNG ? Hummmm
Fuel Cells ? Hummmm
Electric ? eeeek



Perceived Electric Car

- Appearance and design - Up to now small three/four wheelers, or square boxes or quirky cars.
- Range – 30 to 40 miles usually
- Low Performance – speed and acceleration

If the public were asked what they thought an electric car was, the words “milk float” more often than not came to mind.

What would change peoples minds and influence the use of electric cars ?



Electric Car Industry 2006

Shift 07 Conference “ Battery/electric vehicles increasingly seem the way forward. Brands such as NICE, G-Wiz (London), Think (Norway, US, UK) and the Fish (California) are offering cars now. “



What would change peoples minds and influence the use of electric cars ?



Lightning Car Company - 2007

- Lightning Car Company formed in February
- Small dedicated team currently headed by :
 - Iain Sanderson CoFounder and CEO
 - Arthur Wolstenholme CoFounder and Technical Director
 - John Paterson Head of Engineering
- Started work on designing the UK's first Electric GT Sportscar
 - Daniel Durrent - Head Graphic Designer
- First Press release of the future technology in 2007
- Eight months from a drawing to an International Show Car (Team of five)



LIGHTNING
DESIGN PROCESS
FINAL DESIGN



LIGHTNING



2007 Final Computer Design Sketch

Daniel Durrent



Design Strategy

1. Design for our business model and business strategy (Top down approach)
2. Design in technology that would meet the performance criteria required.
3. Design using the very latest innovative technology that would form the next generation and the future for electric vehicles.
4. Design in technology looking at how we use the electric car

Also design cars that people would desire to be seen in. Focus on elegant British design to change peoples perception of electric cars.



Lightning GT - Vehicle Components

- No engine, gearbox, clutch, bell housing, oil cooler, radiator, header tank, steering pump, transmission cooler,
- No exhaust manifold, catalytic converters and silencers,
- No fuel tank, fuel pipes, filter and pumps
- No propshaft, differential, drive shafts, CV joints, (in-wheel motors)

- Minimum of moving parts

- Weight distribution which in many ways can be superior to the ICE.
 - Low centre of gravity
 - No variable heavy fuel tank weight at the rear



In-Wheel Motor Technology

- Greater efficiency of transmission (ie conventional system has over 15% mech. Losses)
- Few moving parts (wheel bearing) and number of components
- Frees up internal vehicle space
- Full four wheel drive capability

Conventional ac induction motor technology (even today) could not meet the performance criteria.



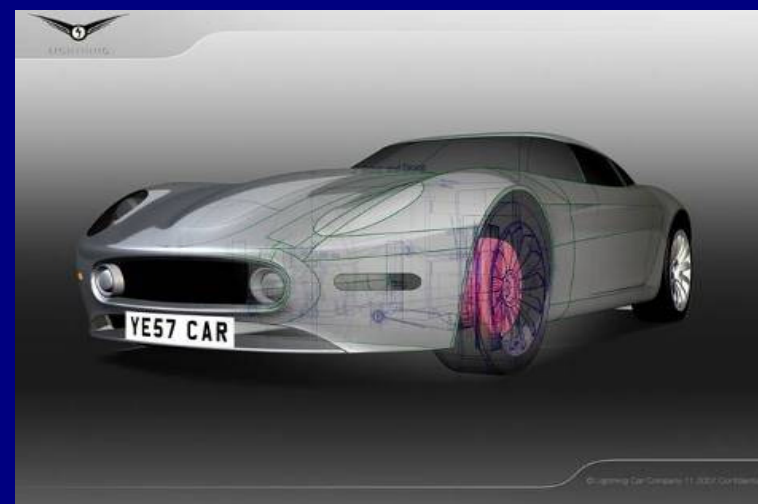
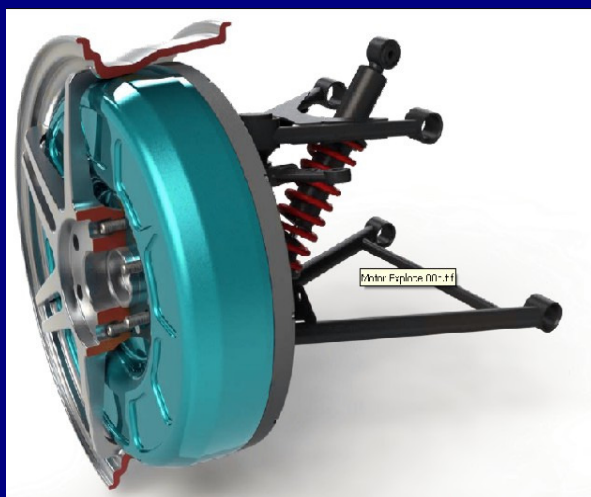
Lightning GT - Motor Technology

Brushless DC PM in-wheel Technology

100kW @ 400V, Torque 1100 Nm (peak figures)

High Power & Efficiency Speed 1650 rpm

Extremely high power density within minimal size/weight package



The most advanced motor technology available in the world



Lightning GT - Lithium Titanate Battery Technology

- Nano technology - Safety
- 36kWh pack
- Pack max continuous amps 1100A (1600A peak) @ 400V
- Captures all available regenerative energy by the ultra high power system
- Wide temperature operation – 40 C and + 55C cell nominal temperature
- No restriction of discharge/charge percentage ie 0 – 100%
- No liquid or forced air fan cooling to waste energy (Europe)
- Long life Battery - Typically 15 years of charge/discharge every day

The most advanced battery technology available in the world



Braking Systems

- Fully blended regenerative/friction 4wd braking system
- Additional dual friction braking system acting on all four wheels
- Handbrake system

(designed to capture as much regenerative braking energy as possible)



Lightning GT - Charging Systems

On Board Charging

- Cable and Wireless charging:-
 - Standard Charge - overnight by 13A 240V outlet
 - Fast charge from - dedicated 9/18Kw high power outlet
- Off Board Commercial Charge option
 - Ultra fast charge – special equipment/supply

Alternatively energy storage systems in the household could be charged by renewable sources:-

- Wind Energy
- Solar Energy



The Electric Lightning GT

POWER 4wd

400 plus BHP

TOP SPEED

130 MPH limited

ACCELERATION

- **100kW Motors x 4 total**
- **available torque Max**
- **Target acceleration time of 0 – 60 in**

400kW max power
4400 Nm available
less than 5 seconds

RANGE – Target UDDF cycle

180 miles

VEHICLE WEIGHT

1600Kg max

CHARGE TIME from zero

- **Standard home charge**
- **Fast Charge home high power socket**

3kW 13 hours
18kW 2.25 hours

Commercial off board option

- **Ultra fast charge 3ph supply - from zero**

less than 10 minutes











LIGHTNING

“The electric Lightning GT isn't just a hugely desirable and sexy performance coupe, it could also hold the technology that will change the way we drive forever”

***Quentin Wilson – Motoring Correspondent -
Sunday Mirror July 2008***

Geneva Motor Show 2009



ELECTRIC LIGHTNING GT



Photographer :: Colin Curwood CGI and postproduction :: www.drivedesign.co.uk





LIGHTNING

LIGHTNING RANGE of Electric Cars

World Reaction

Since launching the Lightning GT at the International British Motor Show in 2008 we believe we have influenced the automotive industry globally in the way forward and in the technical innovations we have designed in.

Since that date every major car manufacturer is now working on a full electric car. But by being a small company and using our key technical partner companies we can react much faster to change than the major car manufacturers, and at a fraction of the cost.

We have three key technologies and in Europe major automotive manufacturers and many governments have discussed Lightning and have looked at our technical specification as key to the future generation of EV cars.

Our vision and the decisions we made in 2006 have proved to be right



Building a European Car Company

- **During 2009 we introduced the Lightning GT and brand into Europe via Geneva. Also we have produced further Lightning brand EV designs based upon shared common platform technology.**
- **Prototype engineering and development “Stage 1” has been completed with Stage 2 already started.**
- **Continuous development of the key technologies with our partners is on schedule and pre-production trials are exceeding expectations.**
- **Phase two funding required in January 2010 to join with the recent TSB Grant, part of the EEMS (Efficient Energy Motor Sport) consortium, awarded to Lightning to accelerate development of the first two Lightning GT cars. Currently these are on schedule to be on the road within seven months.**
- **Phase two engineering program has already started in the integration of CAD data and surface modelling with the latest engineering internal chassis and battery data; work being carried out with our Spanish engineering, test & homologation partner.**





The Electric Lightning GT – The first British GT electric car that could challenge the performance of a Ferrari, the elegance of an Aston Martin.



Thank you
Arthur Wolstenholme