



Three stages of the REEV project: The Lotus Evora 414E Hybrid concept car, Evora 414Evolution cut-away technology demonstrator and the running prototype Evora 414E REEvolution



**HALOSONIC SOUND AND VISION**

The latest version of HALOsonic, a collaboration between HARMAN and Lotus uses a single camera to determine the distance, trajectory and speed of pedestrians and other road users, calculating the risk of collision by comparing this information with the car's path.

The new HALOsonic system uses this data to actively control the volume of the External Sound Synthesis to warn pedestrians of the vehicle's location, thereby improving pedestrian safety and reducing noise pollution. Under certain conditions the system will generate an audible and visual warning for the driver using the Internal Sound Synthesis and instrument panel.

The new active system is optimised to operate in urban environments where there is the greatest risk of a collision with a pedestrian. It is calibrated to actively control the volume and pitch of the sound synthesised while the vehicle is travelling up to 45 mph (75 km/h), continually evaluating the risk of a pedestrian collision and operating in an area up to sixty metres ahead of the vehicle.

**SIMULATED GEARSHIFT**

The car has a simulated paddle shift gear change offering ultra quick gear changes reminiscent of a dual clutch transmission. This enhances the driver interaction with the vehicle and provides a driving experience similar to current internal combustion engine high performance sports cars.

The drive torque is also modulated to simulate a physical feeling of a gearshift jolt. This offers the driver the ability to control the vehicle deceleration by simulating engine braking through a virtual downshift in gears.

The Lotus system effectively allows the driver to select the appropriate level of regeneration by simulating a sequential stepping down of gears. The simulation of engine braking through both the gear noise change and the retardation of the vehicle is fully intuitive to a driver familiar with a conventional gearbox.

**INNOVATIVE THINKING FOR HYBRID AND ELECTRIC VEHICLES**

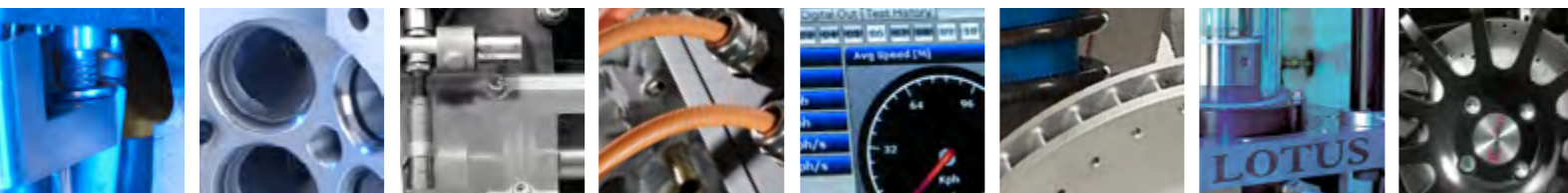
The Lotus Evora 414E showcases new developments in plug-in, range-extended electric propulsion, new electronic technologies to enhance driver involvement, the adaptability of the Lotus Versatile Vehicle Architecture (VVA) that underpins the Lotus Evora and a dramatic new roof system and interior concept from Lotus Design.

Lotus and HARMAN have created a next generation intelligent pedestrian warning system, integrating the advanced HALOsonic sound synthesis system with video technology. This cutting-edge enhanced version of the HALOsonic safety system incorporates input from imaging sensors to enhance the quality of the sound synthesis system.

HALOsonic has been developed specifically for hybrid and electric vehicles.



LIGHTWEIGHT ARCHITECTURES - EFFICIENT PERFORMANCE - ELECTRICAL AND ELECTRONIC INTEGRATION - DRIVING DYNAMICS



**VEHICLE SPECIFICATION**

Power	414 PS (408 HP)
Torque	1,000 Nm (738 lb/ft)
Top Speed	130 mph (209 km/h)
Acceleration	0-60 in around 4.4 seconds
Electric Range	30 miles (48 km)
Full Range	300 miles (483 km)
CO <sub>2</sub> Emissions	55 g/km (NEDC)

**KEY FEATURES**

- Range extended hybrid electric drivetrain
- Eco mode or sports mode featuring simulated seven speed paddle shift with energy recuperation
- HALOsonic internal and external electronic sound synthesis
- Torque vectoring for improved dynamic stability

**UNITED KINGDOM**

Potash Lane  
Hethel, Norwich  
NR14 8EZ  
Phone: +44 (0)1953 608423  
eng-uk@lotuscars.com

**USA**

1254 N. Main Street  
Ann Arbor  
MI 48104  
Phone: +1 734 995 2544  
eng-usa@lotuscars.com

**CHINA**

7th Floor, New Jinqiao Tower  
No.28 New Jinqiao Road, Pudong,  
Shanghai. PR CHINA 201206  
Phone: + 86 (21)5030 9990  
eng-china@lotuscars.com

# LOTUS EVORA 414E REEVOLUTION

## OVERVIEW

### RANGE EXTENDER ENGINE

The Lotus Range Extender is an extremely compact, lightweight, low-cost engine and generator, designed specifically for hybrid electric vehicles. The production Lotus Range Extender will be offered in two versions with the top of the range 50 kW supercharged variant installed in the cutaway Lotus Evora.

The 1.2 litre, three cylinder Lotus Range Extender engine offers high efficiency and low mass, which will enable the downsizing of expensive batteries, whilst maintaining vehicle efficiency and range of hybrid electric vehicles.



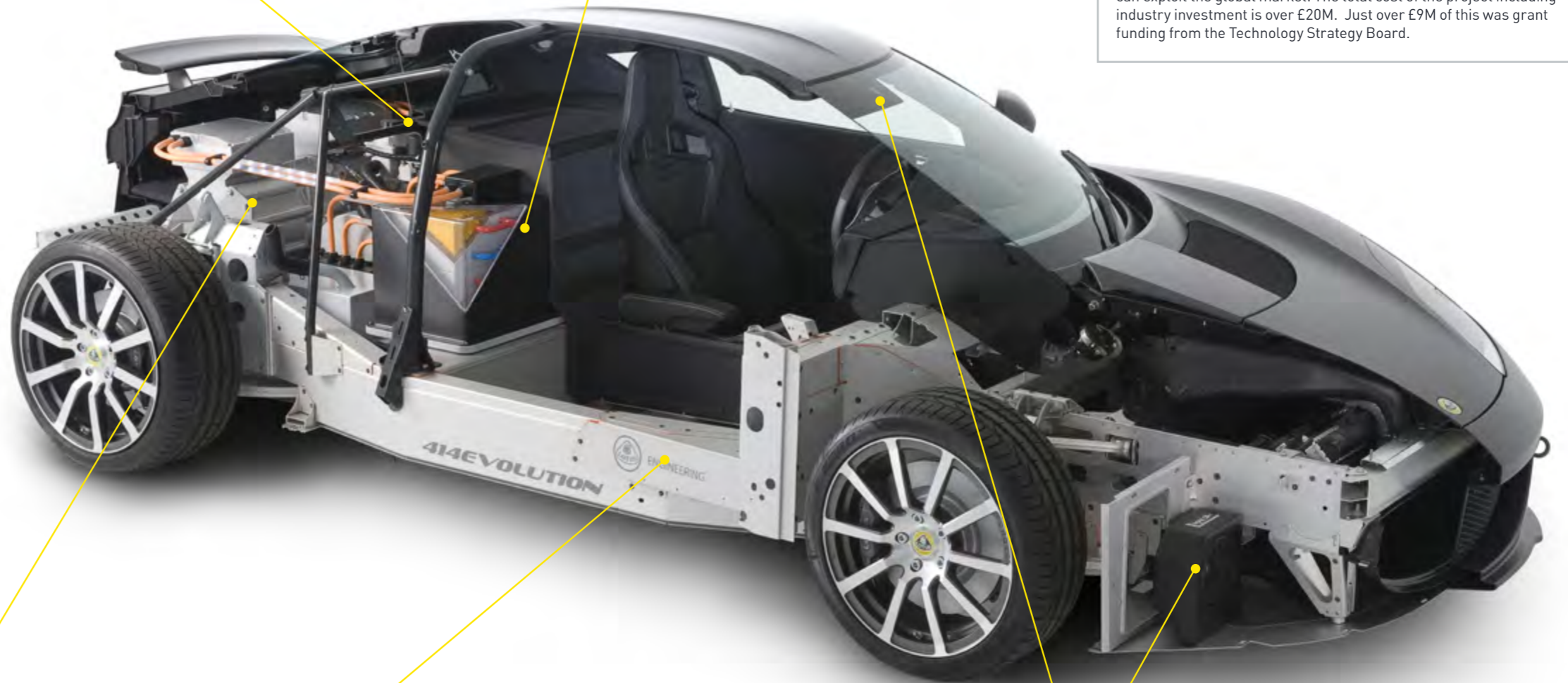
### ELECTRIC DRIVETRAIN

Each drive wheel is connected to a 150 kW axial flux drive motor with integrated inverter which allows for independent rear wheel control. The inverters convert DC voltage from the battery into three-phase voltage for the drive motors.

### ENERGY STORAGE SYSTEM

The vehicle energy storage system is made up of the latest lithium polymer battery chemistry providing 14.4 kWh energy storage capacity. The battery pack is optimised for energy density, efficiency and high power demand, with over 300 kW discharge capability. For everyday commuting journeys, up to 30 miles (48 km) can be travelled using battery power. The battery can be charged overnight using a conventional domestic mains supply.

For longer journeys, exceeding the battery capacity, the highly efficient range extender engine is used as a generator to supply the motor with electrical power and top up the battery.



### VERSATILE VEHICLE ARCHITECTURE (VVA)

The VVA chassis used on the Lotus Evora, is a low volume evolution of the architecture used on the Lotus APX concept and allows for the development of a range of vehicles up to a gross vehicle weight of 1,900 kg.

The VVA architecture has been designed so that it can be stretched in width, length and height vastly increasing the number of vehicles that could be developed from this vehicle architecture. Front and mid engine installations have been considered, as well as hybrid and electric vehicle applications.

### HALOSONIC

HALOsonic technology synthesises internal and external engine sounds for enhanced pedestrian safety, driver feedback and enjoyment. The HALOsonic system is now integrated with an advanced driver assistance system providing warnings to both pedestrians and the driver of potential danger.

Selectable engine sounds from the HALOsonic system combined with a simulated seven speed paddle shift transmission provide increased driver involvement.

### Technology Strategy Board

Driving Innovation

REEV is a Collaborative R&D project funded by the Technology Strategy Board that is creating new high performance Range Extended Electric Vehicles (REEV) and Plug-in Hybrids Electric Vehicles (PHEV).

The REEVolution consortium, led by Jaguar Land Rover consists of three suppliers: Axxon Technologies Ltd, EVO Electric Ltd and Xtrac Limited; and three vehicle manufacturers: Jaguar Land Rover, Lotus and Nissan Motor Company Ltd. for INFINITI brand.

Three demonstrator vehicles (414E, Emerge-E and XJ-E) showcase innovative new technologies. The cars are 'best in class' and combine and build on the skills of all of the businesses involved.

The driving force behind this is to build a UK supply chain for new ultra low carbon vehicle technologies and position suppliers so that they can exploit the global market. The total cost of the project including industry investment is over £20M. Just over £9M of this was grant funding from the Technology Strategy Board.

