

Vehicle design for leisure attractions



DCA were approached by the vehicle manufacturer Severn Lamb, to design a new electric vehicle for a leading Barbados tourist attraction. The vehicle was designed for operation in the demanding and beautiful Harrison's Cave. The vehicle set consists of a lead vehicle with a driver and guide seat and two trailers each with a capacity of 16 passengers. A wheelchair accessible trailer and a maintenance vehicle were also designed as part of the fleet.

As part of a major construction project re-launching Harrison's cave, the new vehicles were required not only to be an accessible and robust design but also a memorable and distinctive part of the tour. Working closely with the client to understand the vehicle environment was essential. The dark and humidity all make demands upon the driving and passenger environment. It was important that these demands were met with a comfortable, accessible and reassuring design.

The four-wheel drive electric vehicle was designed in conjunction with Severn Lamb and a number of vehicle component suppliers. Short time-scales were made possible by designing and transferring data in 3D CAD from the outset to allow the completion of the design within three months.



Sketch development



Ergonomic rig



Structural design



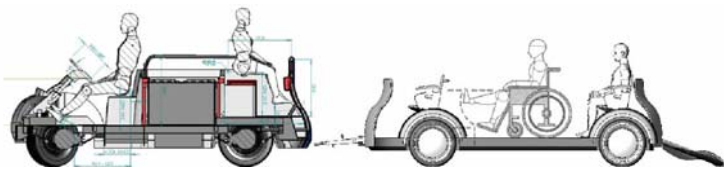
3D rendering

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Following the initial concept and packaging design phase an ergonomic mock up of the complete vehicle rake was made early on to test the design. A full range of percentile sizes were evaluated using and servicing the vehicle mock up. Trials included wheel chair users and those with limited mobility. A test with a fully occupied vehicle was also conducted to confirm sight lines and assess passenger embarking and alighting.

The rig enabled development and client sign off of the optimum driver, guide and passenger environments. Particular attention was paid to the driving area using a rig to test the positioning and fit of the switchgear, and the aesthetic design to achieve an open design that took advantage of the viewing angles afforded by minimum vehicle overhangs



Ergonomic development

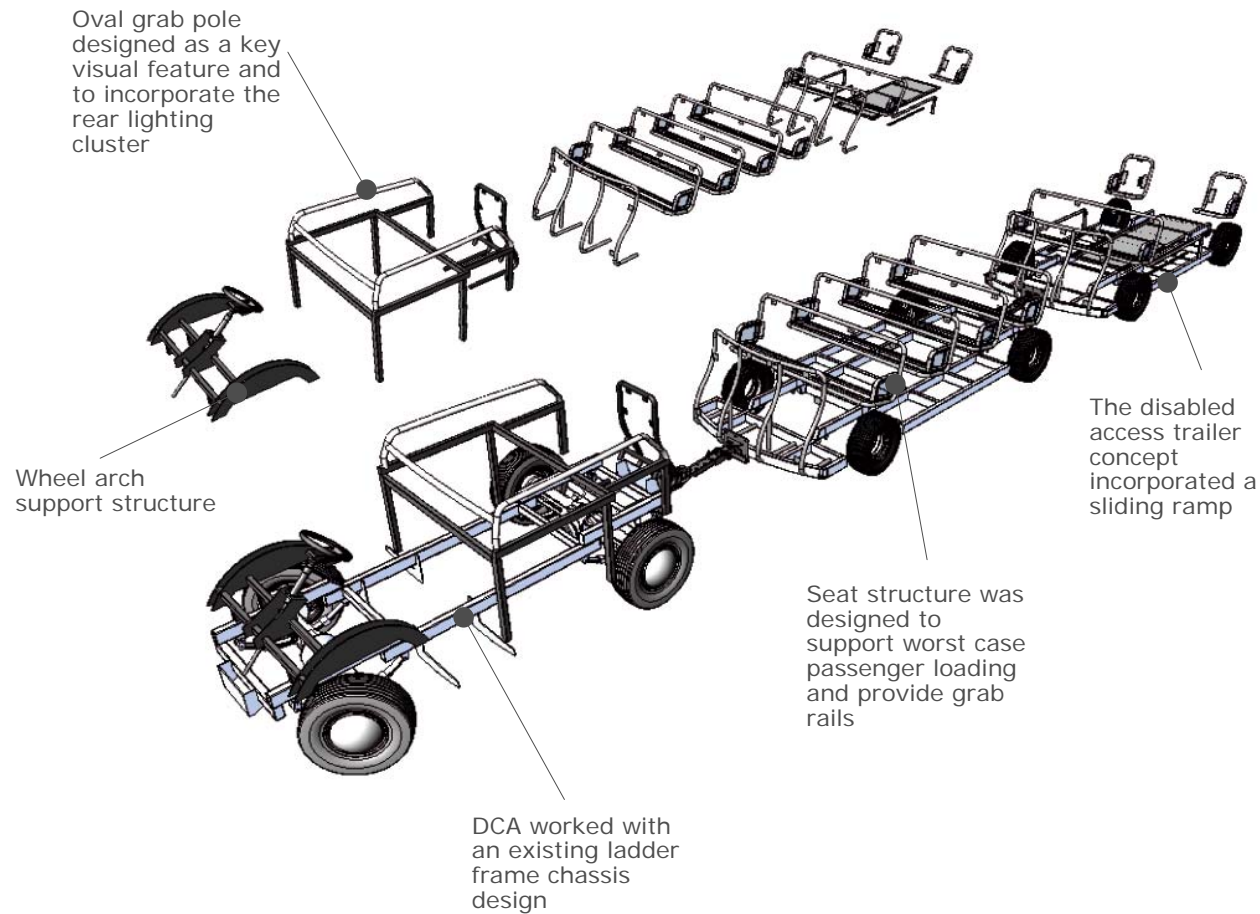


Ergonomic rig



Completed cab

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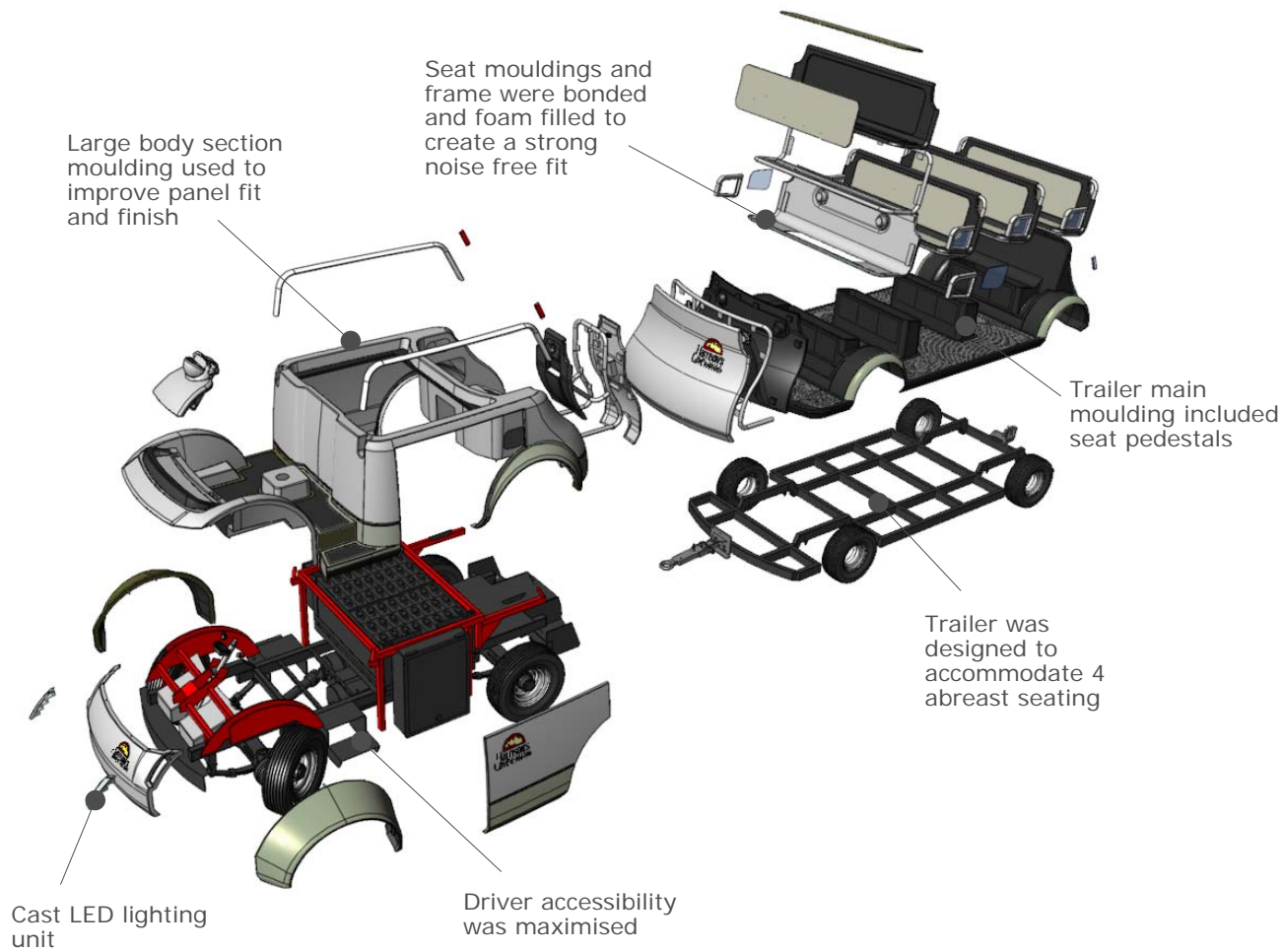
A ¼ scale physical model of the exterior was used to refine the surfaces and the vehicle was then designed and detailed comprehensively in 3D CAD. Integration and simplicity of design was fundamental in achieving mass production vehicle quality using small batch bespoke fabrication techniques.

Working with an existing ladder frame design for the tractor and trailer DCA designed the structure to support the body panels and seating.

DCA assisted Severn Lamb by designing and supplying the original headlight and rear light units. The bespoke LED units provide a distinct vehicle look and are maintenance free and low power consumption.

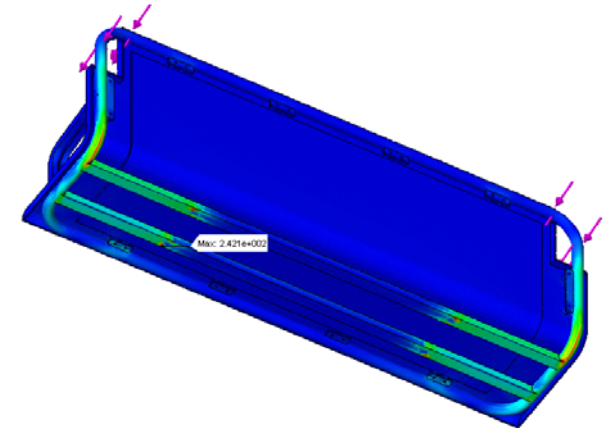


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DCA designed and analysed the body panels and the fabricated structural elements using 3D CAD and Finite Element Analysis (FEA). For rigidity and split line reduction the main body was designed as a single piece. Damage prone elements - the front wings and front panel are designed as separate items to be easily replaceable in the event of a collision. A large horizontal central access door enables removal and maintenance of the battery pack using a forklift and forms an area for the storage of baggage and tools.

The passenger seating was optimised to provide comfort for the short journey times and incorporate a small seat pad and an arm rest that doubles as a grab for boarding.



FEA of the complete passenger seat system

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1/43rd scale model

Expertise from rail vehicle design was used to select materials carefully to provide low maintenance and fire performance. The body panels are made from Phenolic, (used in London Underground vehicles for its exceptional fire performance) and the seating from fire resistant foam and upholstery material. The colours and livery were selected with the client to provide an understated modern feel.

DCA undertook a formal review of the first prototype vehicle set to highlight any design or build issues ahead of manufacture of the production vehicle sets. After this, 6 vehicle sets were produced, in addition to the disabled access and maintenance vehicles.

DCA also produced a ten sets of highly detailed 1:43 scale models of the vehicles for display in the visitor centre. The intention is that these will form the master patterns for the high volume production of die cast models that will be sold as souvenirs to visitors to the caves.



Cast armrest/grab



LED Lighting



Fire and weather resistant materials



Integrated PA system

