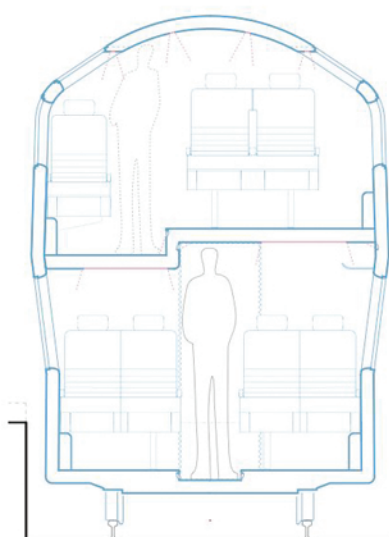


Attracting interest: the AeroLiner3000 mock-up while being exhibited at InnoTrans 2016 in Berlin.



AeroLiner cross-section: a low ceiling height on one side of the lower deck provides the space for the upper deck aisle.

Consistent use of lightweight construction techniques that reduce the weight of the car body, along with optimised aerodynamics, reduce operating and maintenance costs and limit carbon dioxide and noise emissions.

FLEXIBILITY

The lightweight construction principle will enable a double-decker car for GB PG1 gauge to be in line with the Passengers with Reduced Mobility TSI standards and offer better seating comfort than many UK trains currently in operation.

The car body structure has the structural characteristics that are needed to ensure stability. This means that the interior of the carriage can be designed flexibly, for example with regard to the design and shape of the intermediate floor.

CAPACITY AND COMFORT

Compared with a standard British single-deck train fitted with 500 seats, with a distance between seat backs of 830mm (as found on existing Mk 3 carriages), the AeroLiner3000 has around 30% greater seating capacity. It has 700 seats, around 170 in first and 530 in standard

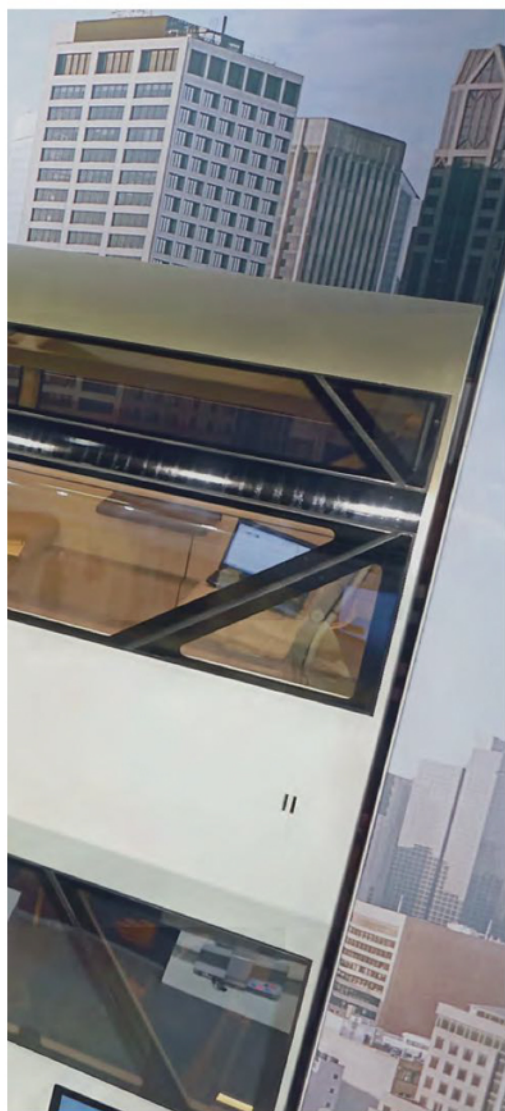
class. The distance between seat backs remains 830mm in standard class. Aside from the pitch, with slim but elegant seats providing maximum leg space, passenger comfort is achieved by low noise, vibration and pressure variations, improved air conditioning and interactive smartphone-based passenger information.

An advanced airflow ventilation system from the aerospace industry is under investigation. An innovative heating, ventilation and air conditioning (HVAC) concept using crowd-sourcing is also proposed. Electronically dimmable glass in the windows allows sunlight to fade in and out before and after tunnels, thus avoiding glare shocks in the eyes of the passengers. Further, they can actively control the HVAC system, both in summer and in winter.

The illumination concept employs organic light emitting diode (OLED) technology, which is the perfect choice, since it can be built into the lining with less than 3mm depth, providing a glare-free, dimmable and comfortable light. The illumination system works together with the shading of the windows and proactively takes into account abrupt light changes.



AeroLiner elevation: the centre single-deck car could accommodate wheelchair spaces and a buffet area.



CAREFUL DESIGN

The exterior design combines the blueish dimmable windows with an elegant line of metallic champagne colour, providing a new appearance in the British landscape and an interesting reflection of light.

The spacious entrance vestibule welcomes the passenger and provides an easy orientation. From here two airline-style toilets are accessible, as well as a luggage rack.

The lower deck is reached by a short flight of shallow steps down from the vestibule. Here there is 2+2 seating. One side has a lowered ceiling height, making it feel like an aeroplane.

Interior illumination is by way of organic LEDs, and the glazing is light-sensitive, automatically becoming more tinted when exposed to strong sunlight. The windows, divided by the slim, elegant diagonal posts, provide a generous view outside and no seat is without a window (something many current trains don't achieve). Additionally, the walkway and the edges of the cabin space are illuminated by LED strips, which increase security but also widen the appearance of the space by an airline-like elegance illumination.



Upper deck: the curvature of the upper level of the vehicle to accommodate the UK loading gauge limits the seat layout to 2+1. The mirror on the mock-up gives the impression of a full-length vehicle.

A longer flight of stairs, also with shallow risers, accesses the upper deck. Here one of the most noticeable features is the provision of panoramic windows in the curved section of the roof, above cantrail level. At this height both headroom and width permit only a 2+1 seating configuration. However, a long sideboard makes good use of the space and generates a generous business-jet-like feel. The single seats, adjacent to the aisle, are on the same floor level as the aisle. The double seats are on a slightly raised platform; this is necessary to provide greater headroom on the lower deck.

The interior design for the full scale mock-up has been carefully developed. The windows are a crucial interface between engineering and spatial interior design. The large windows enhance the experience of the cabin space. The diagonal window posts are covered by an elaborate shape of convex and concave curves: this shaping is similar to limousine interior design.

The seats provide good lumbar support and are covered with textile and partial leather to provide a limousine feel. These little comfort details provide passengers with the feeling that they are valued by the operator and that they are getting what they have paid for.

CAPACITY AND CUSTOMERS

The benefits for the travelling public will be:


- more capacity on railway lines, less infrastructure expenditure, cheaper tickets;
- less road and air congestion;
- less air and noise pollution;
- travel time saving;

- travel time becomes value time for former motorists;
- more comfort;
- fewer complaints.

The benefits for the UK rail industry and suppliers will be:

- new technologies built in the UK, adding know-how and competence to the UK rail industry;
- market development of double-decker trains of interest to railways with low structure gauges elsewhere in the world;
- increasing demand for rail travel because of increasing comfort, decreasing costs, etc;
- initiation of changing industry paradigms from 'keep a system running' to 'make a system running at its best'.

THE FUTURE

Currently the AeroLiner team is leading negotiations around the production of a certified 17m prototype coach to run on existing lines for testing and collection of passenger opinions. 

Andreas Vogler is CEO of Andreas Vogler Studio in Munich and has been the design and management lead of the AeroLiner project. He is a licensed architect and has a background in aerospace design.

Dr Joachim Winter is Senior Scientist and Project Manager of the 'Next Generation Train (NGT)' research project at the German Aerospace Center, Institute of Vehicle Concepts DLR in Stuttgart. He is an aerospace and mechatronic engineer and director at Bombardier.

MOCK-UP SUPPLIERS

The following companies and their products were involved in building and fitting out the 1:1 mock-up:

- Main contractor: GETA mbH, Wangen, Germany
- Structural analysis: IB-Reinecke, München, Germany
- Dimmable windows: Vision Systems, Brignais, France
- Illumination: OLEDWorks GmbH, Aachen, Germany
- Electrics: Stehle Elektro GmbH, Neukirch, Germany
- Seats: RICA, Riihimäki, Finland
- Leather: Lantal Textiles AG, Langenthal, Switzerland

