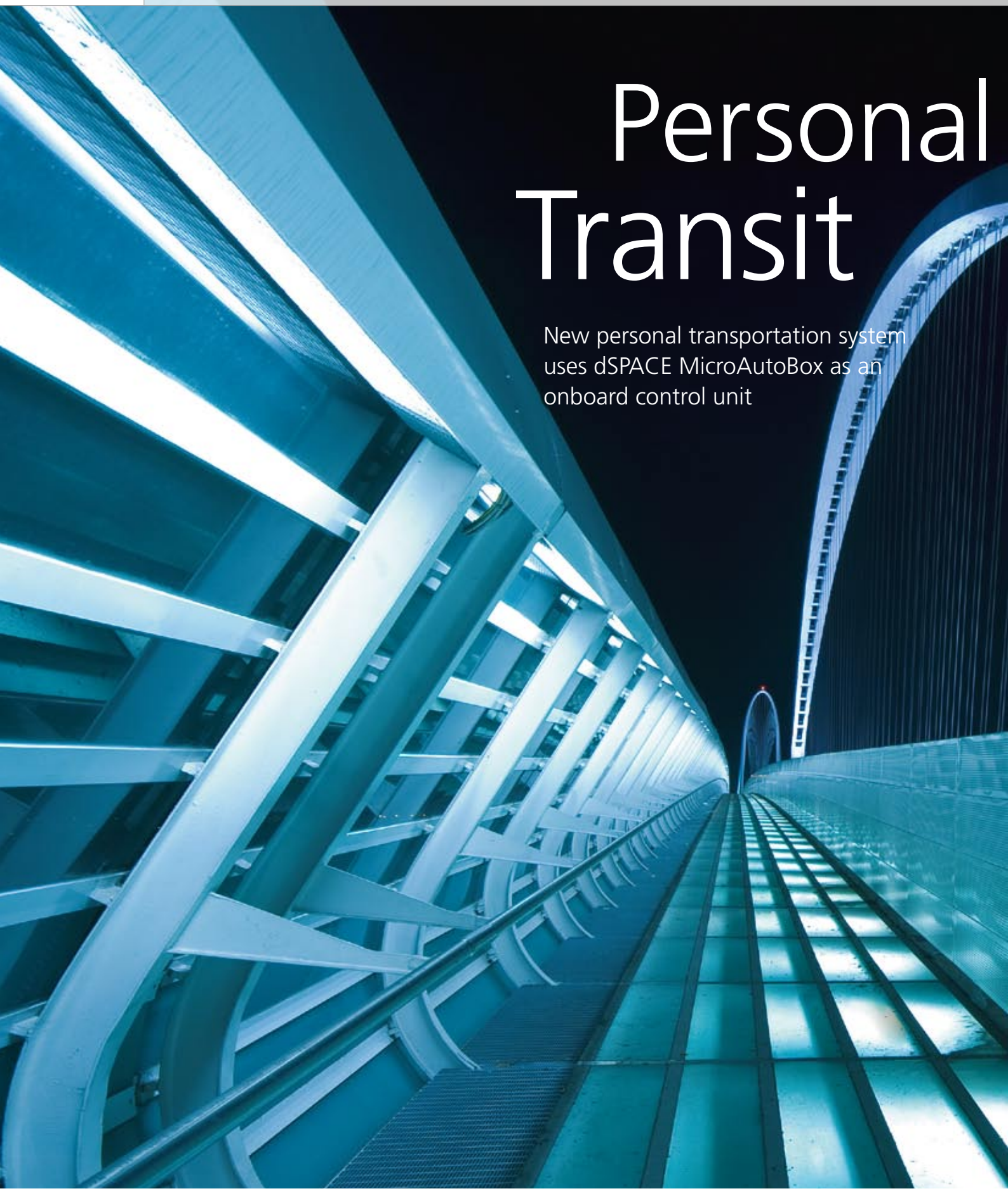


Personal Transit

New personal transportation system uses dSPACE MicroAutoBox as an onboard control unit

Rapid

Welcome to the future! From 2009 onward, passengers will be able to travel non-stop across London Heathrow Airport in the ULTra Personal Rapid Transit (PRT) system. This new, environmentally friendly, individual passenger transportation system has been developed by ATS Ltd. The airport operator is using 18 vehicles in the pilot phase – each controlled by its own dSPACE MicroAutoBox as it travels along a 3.8 km guideway network.

Passengers request their destination at the station and then board their ULTra PRT vehicle. The vehicle travels to the destination non-stop in the slot allocated to it by the synchronous control system.

Intensive Trial Phase

The ULTra PRT system due to go into operation at Heathrow has been under development for over 5 years. Mule and pre-production prototype vehicles have been tested extensively at ATS's Test Track in Cardiff (Wales). Testing has included passenger trials encompassing a wide range of users, including those with disabilities. The test program has demonstrated the reliability of the vehicles including their batteries and opportunity-based battery charging strategy. The use of onboard batteries for power storage is considered to be a key feature of the system design since it avoids the high infrastructure cost and single-point-of-failure issues associated with continuous power pick-up systems.

The Control Unit: The Heart of the PRT System

ATS Ltd. is using dSPACE MicroAutoBox as the ULTRa PRT's onboard vehicle control unit throughout development and is using them for the pilot system vehicles. The MicroAutoBox executes the main vehicle supervisory control functions, the guidance and navigation functions, and autonomous driving (communicating with smart actuators for steering, drive and braking functions). The MicroAutoBox is also in charge of controlling ancillary systems such as HVAC (heating, ventilation, air conditioning), lighting, and battery charging, and performs fault detection and health monitoring functions. To ensure safety, a guideway-based Automatic Vehicle Protection (AVP) system is used to ensure that safe separation is maintained between vehicles at all times. The MicroAutoBox plays an important role in this system, initiating emergency braking when commanded to do so by the AVP system. The PRT system is subject to Her Majesty's Rail Inspectorate (HMRT) regulation, and throughout development ATS have maintained a dialog with HMRI so as to ensure a smooth passage to safety approval.

> "Reliability and flexibility were our main concerns in choosing the onboard control units for ULTra PRT, and the MicroAutoBox gives us both."
>
> *Dr. Torquil Ross-Martin, ATS Ltd.*

The World's First PRT System

The ULTra PRT developed by ATS Ltd. from Bristol (UK) is the first system ever of this type in the world. ULTra's synchronous control works on the slot principle used in air traffic control, in which a vehicle sets off as soon as a route is guaranteed to be free from the starting point to the selected destination. Delays or jams never occur – each vehicle travels non-stop to its destination in a specially reserved slot and by the fastest route. The vehicles roll on tires along a special guideway made of concrete and steel. The four-seater vehicles are around three and a half meters long, barrier-free, and can carry a 500 kg payload. Each has its own autonomous, battery-powered electric drive and is controlled by its own dSPACE MicroAutoBox. Passengers select their destinations at the station, and they can also choose who they travel with – just like traveling by car. The environment also benefits, since ULTra PRT's battery-powered vehicles require only about a third of the energy consumed by a car per passenger kilometer. This dramatically reduces the volume of CO_2 emitted by the overall system per passenger kilometer.

Looking Forward

From 2009, the ULTra Personal Rapid Transit system will go into pilot operation on a 3.8 km guideway network at London Heathrow Airport. In the first phase, it will connect Terminal 5 and a business parking facility. After successful completion of the pilot project, ULTra PRT will be extended to other parts of the airport, connecting other terminals, hotels, car rentals, and multi-story parking facilities. ATS Ltd. and its business partners are already planning other projects in Europe, the Middle East, and the USA. ATS plans to continue adding functionality to its vehicles and expects to continue utilizing dSPACE systems in their development.

Interview

with Dr. Torquil Ross-Martin, Head of Research and Development, ATS Ltd.

Dr. Ross-Martin, why did ATS Ltd. decide to equip each vehicle in the ULTra PRT system with its own dSPACE MicroAutoBox?
Reliability and flexibility were our main concerns in choosing the onboard control units for ULTra PRT, and the MicroAutoBox gives us both. The powerful processor and large memory and I/O count mean that we have the reserves we need, especially in prototype operation. It gives us the flexibility to meet new customer requirements or make extensions, and we were able to go into production early in the knowledge that there were plenty of resources left for later requirements. It's an established, proven product with an effective tool chain, and has completely met our expectations.

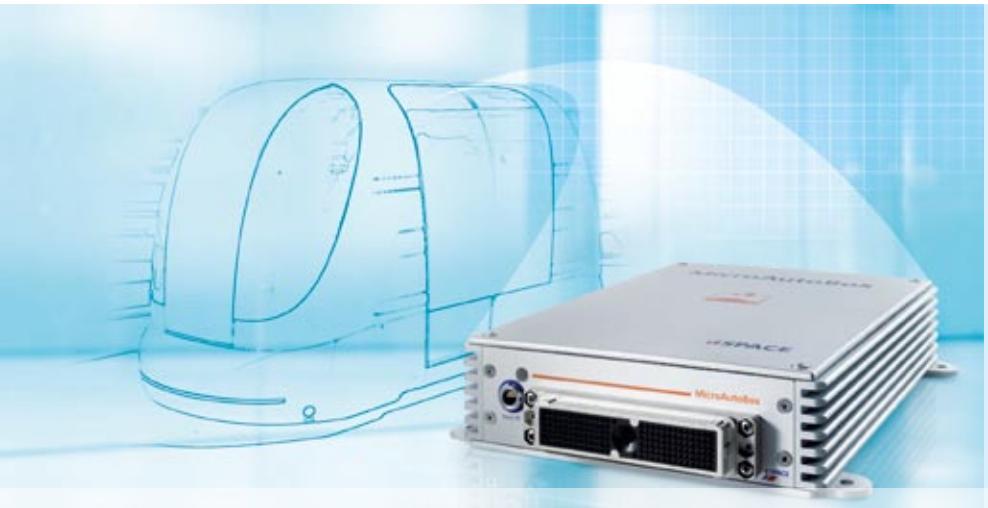
What was the most critical part of control development for the ULTra PRT?
For everyday operations, we had to make the system robust against faults and errors and also develop suitable diagnostic and corrective mechanisms. This was a greater challenge, and we met it – as approval from Her Majesty's Rail Inspectorate shows.

Dr. Ross-Martin, what makes your PRT system so outstanding, compared with bus and rail transport?
Buses and trains are usually only available according to a fixed schedule. They stop at numerous stations, which are irrelevant for the passengers not getting off. This makes journeys unnecessarily long. The ULTra PRT from ATS Ltd. gives passengers independence. A separate vehicle is allocated to each passenger or each group of passengers and their baggage, and it takes them straight to their destination without stopping. Passengers will no longer have to bother with schedules or share vehicles with strangers.

How do you see the future of ULTra PRT?
Our system has been designed primarily to provide transport in urban areas – not just the airports and business campuses where it is first being applied. It has great advantages in comfort and convenience compared with conventional public transport and in safety, emissions, and reliability compared with cars. Moreover it is designed as a complementary system – it can be added into existing cities without disrupting established road and rail systems. Thus I expect to see a very strong future with systems appearing in cities within the next 10 years.

Thank you, Dr. Ross-Martin.

Each individual vehicle in the ULTra PRT system has its own MicroAutoBox as an onboard control unit.



Summary

- ULTra PRT – New modular personal rapid transport system from ATS Ltd.
- Control functions developed and tested with dSPACE prototyping systems.
- dSPACE MicroAutoBox has a new job as a regular onboard control unit.