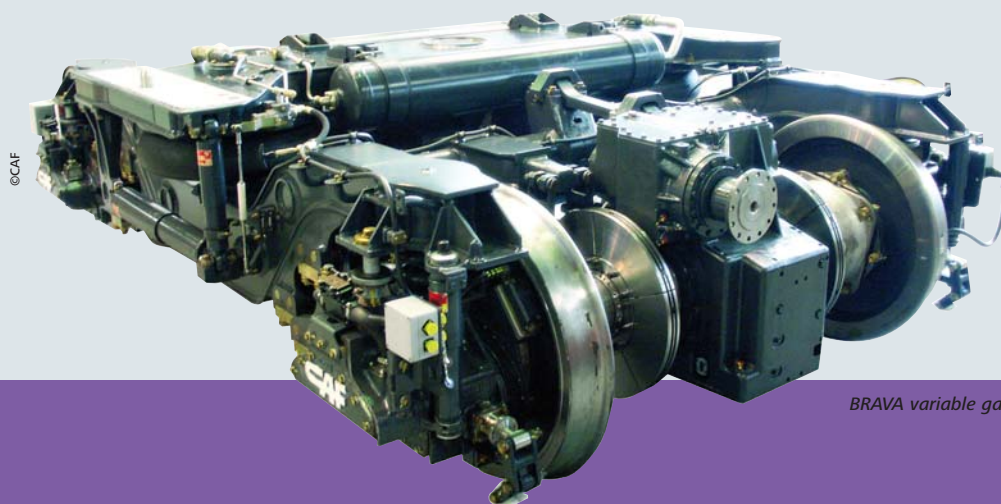


AVI-2015 TACKLES INTEROPERABILITY CHALLENGES

THE AVI-2015 PROJECT, LED BY SPANISH RAIL VEHICLE MANUFACTURER CAF (CONSTRUCCIONES Y AUXILIAR DE FERROCARRILES), AROSE IN RESPONSE TO CURRENT AND FUTURE RAIL PASSENGER TRANSPORT NEEDS. ITS KEY OBJECTIVE IS TO DEVELOP SUSTAINABLE TECHNOLOGIES THAT WILL DELIVER FULLY INTEROPERABLE, HIGH-SPEED TRAINS CAPABLE OF TRAVELLING AT THE MAXIMUM SPEEDS ALLOWED BY INFRASTRUCTURE IN DIFFERENT AREAS, WITH NO REDUCTION IN SAFETY AND REMAINING ENVIRONMENTALLY FRIENDLY.



BRAVA variable gauge bogie. AVI-2015 intends to improve its performance

The driving force

High-speed trains have proven to be competitive with planes for medium distance travel (500–700km). However this is definitely not the case when there is no high-speed inter-city line. Even when there is a rail connection, if it is not high-speed along its entire length then the changeover from a conventional to a high-speed line can be problematic: different catenary voltages, different signalling systems and even different track gauges. At the worst, trains must stop and be changed.

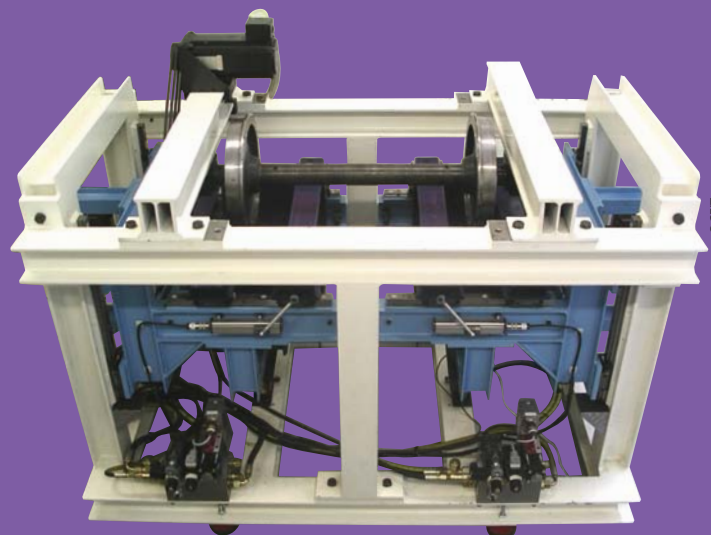
With the deregulation of rail transport, the incorporation of new countries into the European Community and new emerging economies, the future of rail looks promising. But these new market niches are also creating new demands that call for the rail industry to make a qualitative

leap forward if it is to remain competitive. New, fully interoperable trains with performance and safety levels equivalent to those of high-speed trains are going to be required. Trains that are capable of operating at the maximum speeds allowed by different infrastructure and whose life cycle costs (LCC), due to a drastic reduction of initial, maintenance and operating costs are far below current levels.

The rail industry must respond to these new demands. It will not be long before low cost operators appear on the scene, offering highly competitive prices like those already offered by “no frills” airlines. Trains need to adapt to operator requirements: high capacity passenger transport with costs per traveller and per kilometre far lower than current prices.

The problem of total interoperability, including the track gauge, does not just affect countries with a gauge different from the international one; it affects and will affect each and everyone. Operators will provide services today in Germany and tomorrow in Spain or Russia.

In order to meet this challenge, a technological leap forward is required in all key areas of interoperable high-speed trains. In this context, the idea for AVI-2015 – “an integrated, 100% Spanish, high-speed system for Interoperable Railway Networks” – emerged in 2005.



Wheel-rail interface test bench. It is used to determine the friction coefficient under varying conditions and to validate the new dynamometric wheelset

Research activities

In response to the first call for proposals for the CENIT program (National Strategic Technological Research Consortiums) within the framework of the Ingenio 2010 initiative, a consortium of companies headed by CAF was set up and submitted a project. It was amongst the 16 submissions accepted and officially began on January 1, 2006. AVI-2015 will last 48 months.

Its key objective is to develop sustainable technologies that will deliver fully interoperable, high-speed trains capable of travelling at the maximum speeds allowed by different infrastructure, without reducing levels of safety or environmental standards.

Variable gauge system

This is the fundamental factor that guarantees total interoperability, since it enables trains to travel along different gauge tracks.

The best solutions today offer operating speeds of around 250km/hr; still far removed from the velocities achieved by high-speed trains. So the project's objective in this area is to raise the commercial speed up to at least 300km/hr. Based on the design of the BRAVA bogie, studies underway focus on the wheelset.

At high speed in general, and also on variable gauge systems, lubrication is a critical factor. The aim is to develop a new generation of lubri-



New patented concept of elastic joint for improved steering based on an optimized response to the different excitation frequencies

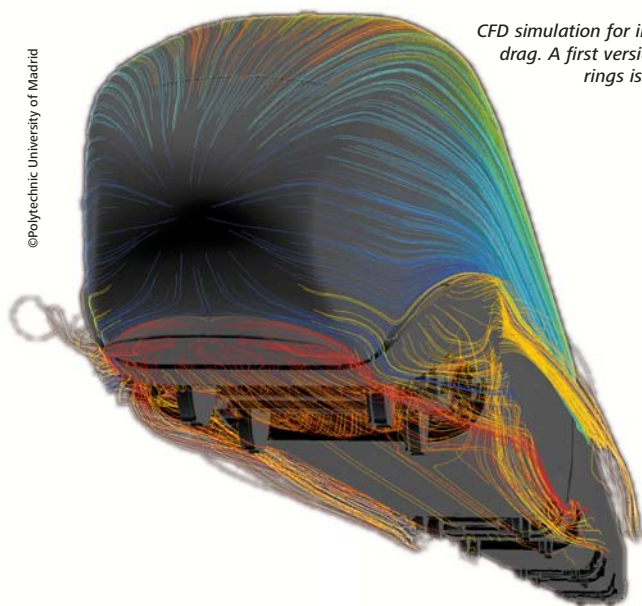
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conventional axle but a fixed one with moving parts. This model must be verified experimentally. The latter will make it possible for variable gauge trains to achieve operating speeds similar to the fastest trains currently in operation, whilst optimising performance.

Railway dynamics

In the field of railway dynamics, AVI-2015 is involved in two work projects. Firstly rail vehicle simulation algorithms are being improved through new, computer generated formulations designed to resolve the wheel-rail contact pro-

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CFD simulation for improving drag. A first version of fairings is included

A complex project with ambitious goals, AVI-2015 is being run by six companies, all leaders in their own particular fields, and eight leading research centres and universities. To achieve its goals, AVI-2015 has been split into several technological areas – the most important are described below.

cants to reduce friction, increase the operating temperature and extend maintenance intervals. On the other hand, the increased speed means that new axle calculations need to be performed, in addition to new models that contemplate the system particularities. We are not considering a



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