

# Spain's Trains to the Plains

*There are 22 different rail signaling and security systems in the European Union member countries. But in the future, a uniform standard known as ETCS will make rail travel across national boundaries easier. The effectiveness of this technology is already being demonstrated by the new Velaro E in Spain — the fastest train on wheels.*

**S**tarting this Fall, the train trip from Madrid to Barcelona will take less than half the time it took in the past. The route, which provides expansive views of unspoiled landscapes as it crosses the sparsely settled plateau on the outskirts of the Iberian Range, will be much faster than ever before thanks to Spain's new high-speed train, the Velaro E. The new train — its name is an abbreviation of VELOCITY Alta (high-speed) España — is Europe's fastest passenger train. It was developed by the Siemens Transportation Systems Group (TS) in Erlangen, Germany.

With a top speed of 350 kilometers per hour, Velaro E covers the 650 kilometers between Madrid and Barcelona in only two and a half hours. No other train currently in

The Velaro E whisks passengers from Madrid to Barcelona, a distance of 650 kilometers, in only two and a half hours — less than half the time needed by its predecessors.



A Siemens ETCS-equipped unit at the Brenner Pass between Austria and Italy

### SMOOTH CROSSING AT THE BRENNER PASS



When it comes to rail transportation, Europe is not as unified as it would like to be. At the Austrian-Italian border, locomotives and even drivers have to be changed. Europe doesn't even offer a standard license for train drivers. This situation has had a particularly detrimental effect on freight transport, with trains having to wait at the Brenner station for a switching procedure that lasts about an hour. This is a major disadvantage compared to truck freight transport, which is cheaper and more flexible. But the "four-system locomotive" from Siemens is now helping the rail system to become more competitive. For a few months now, freight trains pulled by these locomotives have been traveling along Europe's most important Alpine transit route without having to stop at the Brenner Pass. This has been made possible by state-of-the-art electronics and rail safety systems that are compatible with Austrian, German and Italian rail technology. In addition to variable LED lights and multilingual displays, the locomotives have four different pantographs, which can be tipped upwards depending on which voltage system is needed (photo). If, for example, a train arrives at the Brenner station from Italy, the locomotive operator lowers the "Italian" pantograph and coasts the train into Austria, which is just a few meters away. The "Austrian" pantograph is then raised. This procedure takes only a few minutes and enables more trains to travel on fewer tracks. Rail operators can employ fewer locomotives, which reduces costs and shifts traffic from roads to rails. That, in turn, reduces the burden on the environment. "Our gross transport volume increased in 2005 by around 30 percent to over five million tons — partly thanks to the new locomotive," says Dr. Harald Schmittner, head of the Lokomotion company, which is using the new Siemens trains on the route between Munich and Verona. "A 30-percent increase in rail freight transport means about 200,000 fewer drives by truck through the ecologically sensitive Alpine region." ■ Florian Martini

service covers such long a distance at such a high average speed. On the old tracks, the same trip took more than six hours.

The streamlined blue-and-white Velaro E is an enhanced version of Deutsche Bahn's ICE 3 and, except for its colors, its outward appearance is identical with that of its German twin. But many changes were necessary to meet the demands of the Spanish climate. Most of those adjustments run discreetly in the background, such as the air conditioning system that ensures a pleasantly cool environment even at outside temperatures of 50 degrees Celsius. Because winter temperatures along the route, which at some points is 1,200 meters above sea level, can be extreme, the climate control system can handle temperatures as low as -20 degrees Celsius. Engineers in Erlangen matched the train's braking power

be reserved by business travelers. There's also a "Club" class, an even more exclusive First Class, a "Preferente" class and the "Tourista" class, which corresponds to second class. Every class has mini-restaurants that offer a tempting variety of foods and beverages. In the Club and Preferente rail cars, passengers are served at their seats. "For Spanish rail customers, excellent service and an elegant atmosphere are very important," says Angel Perez-Cerezo, who is responsible for local commissioning and training for the Velaro E project at Siemens Transportation Systems. "Alongside the technical features, the rail cars'

offer space for more passengers. "The Velaro is an impressive high-speed rail concept for the global market," says Christian Schlegel, who is responsible for global customer acquisition at TS. "However, to succeed, we must modify the train to meet a wide variety of national requirements at a reasonable cost." In addition to Spain and China, another interested country is Russia. In the future, a Velaro may race between Moscow and St. Petersburg. However, because of Russia's 3-kilovolt overhead conductors, the top speed of such trains would initially be only 250 kilometers per hour.

still has 22 different rail security systems and a range of signals that is as varied as the safety equipment in the locomotives. There are few locomotives today that can cross national borders without problems (see box).

**Automated Trains.** In coming years, ETCS will harmonize national standards for signal technology. The basic idea is simple: Train drivers will receive their driving instructions, such as information on speed limits, via GSM-Rail, a specially developed mobile communications standard. Transmission stations along the route will keep trains in permanent radio contact with control centers. Depending on the system's stage of development, train drivers will either receive all the information in the engineer's cab so that they can control trains themselves (Level 1) or the system will

*No other train currently covers such a long distance at such a high average speed.*



Thanks to under floor technology (above), the Velaro E offers more room, for example in the lounge (middle). The system will enter service this Fall.



design and the fittings played a key role in sealing the deal with RENFE."

**China at 300 km/h.** RENFE is not the only rail operator to be impressed by the new under floor rail concept. China has now ordered 60 high-speed trains based on the Velaro platform. Plans call for the Asian Velaro to enter service in time for the Olympic Games in 2008 on the route from Beijing to Tianjin, an Olympic soccer venue about 60 miles east of the capital. One difference will be that the Chinese overhead conductor system can handle a top speed of "only" 300 kilometers per hour. Siemens will design, engineer and produce the first three trains in Germany. The other trains will be built in a plant of the company's Chinese partner, Tangshan Locomotive & Rolling Stock Works. The Chinese version will be wider than the European one and will

*A freight transport system based on ETCS would significantly ease the burden on Europe's road network.*

**No Stopping at Borders.** The Velaro E is an excellent example of the consolidation of rail systems throughout Europe. For example, it's the first high-speed train that complies with the TSI (Technical Specifications for Interoperability) norm that is valid for all of Europe. Among other things, the TSI sets uniform standards for fire protection and crash prevention. The Velaro E is also equipped with the new European Train Control System (ETCS), which is a milestone for cross-border rail traffic. Thanks to this system, trains will no longer have to stop at borders in order to change locomotives. At the moment, Europe

drive the train fully automatically (Level 3). The train will read its position using electronic beacons called "balises." Small radio units attached to cross-ties throughout the railroad network will be activated and read by radio pulses sent out by passing trains. Train will automatically communicate their positions to transmission stations via GSM-R.

The advantage of this system is that, thanks to the widely accepted GSM-R standard, the signaling system functions throughout Europe. In the future, all trains will operate in line with a standard radio signal, regardless of which country they are traveling in. The

system will replace the many national standards in use today.

**Environmental Protection with ETCS.** Another advantage is that ETCS will operate not only across countries but also independently of particular manufacturers — a feature known as “interoperability.” Today there are many ETCS test routes throughout Europe, for example in Germany and in the Netherlands. To determine whether ETCS is meeting its requirements, Siemens has equipped a test train based on the Desiro rail car with ETCS technology. “Together with third parties, we carried out test runs in the Netherlands. During those tests, the system operated almost as well as it did on the local run to Jüterbog,” says ETCS expert Stephan Klein from Siemens TS in Berlin.

“Technologically speaking, ETCS has been ready for a long time,” says Dr. Ralf Kaminsky, who is responsible for ETCS at TS in Braunschweig, Germany. “Furthermore, the European Union has made interoperability a requirement for all of its member states in order to strengthen the rail transportation network.”

But ETCS will not be universally introduced throughout Europe for some time to come. That’s because countries and railroad operators have different interests. Countries like Germany and France, for instance, which already have sophisticated and powerful train security systems, regard ETCS as a system that would require additional expenditures without initially bringing any domestic benefits. However, according to Kaminsky, “countries that would be instituting such a system for the first time would like to introduce ETCS immediately.”

For this reason, rail industry experts believe that ETCS will first be installed on the main trans-European rail routes, such as the freight route connecting Rotterdam to Genoa. Transporting freight by rail through Germany and the Alpine countries would ease much of the strain on the road network and, thanks to smoother crossings at national borders, would be much faster than transporting goods by ship. What’s more, ETCS will make it possible to shorten the distances between trains, which in turn will boost rail capacity. “The advantages offered by ETCS are obvious,” says Kaminsky, who is convinced that it is only a matter of time before trains are guided through Europe via radio signals. In any case, one of the first ETCS-guided high-speed trains will be the Velaro E, as it zips between Madrid and Barcelona. ■ *Tim Schröder*