A Visit To Newag Granit Locomotives
InnoTrans Megareport III
Stadler’s 1,520mm-Gauge Designs
Eversholt’s Proposal For ECML Trains
Helsinki FLIRT EMUs - The First Venture

Stadler, whose rail vehicles are popular not only in Switzerland, Europe and several other countries, notably Algeria and the USA, is building trains mainly for 1,435 mm gauge networks and lines of narrower gauges. However the Helsinki FLIRT EMU project required trains of 1,524 mm gauge, the order for these being placed in October 2006. This provided an opportune “foundation stone” for the manufacturer to consider building trains for the 1,520 mm gauge market in general, and to participate more widely in tenders for trains of this gauge.

The Helsinki FLIRTS were designated Class Sm5. Initially 32 four-car trains were ordered, and an option for a further nine was confirmed in December 2011. The first train arrived in Finland in November 2008, entering passenger service a year later, and the aim is to have 41 FLIRTs in service by 2014, when the Ring Rail Line is inaugurated, connecting Helsinki-Vantaa Airport with the city centre. By 31 December 2012 21 FLIRTs had been delivered, and these had already clocked up over 4 million km in service. Ten more trains are scheduled for delivery in 2013, and ten in 2014. The 2014 deliveries will comprise the last of the initial batch of 32 and the nine forming the option. When all are delivered, they would, if all coupled end to end, form a trainset 3,075 m long!

The FLIRTS are shouldering an ever greater share of the intensive suburban

Stadler’s 1,520 mm-Gauge Activities

On 24 January 2013 in Tallinn, Stadler organised a conference presenting the company’s successes and future plans relating to trains for the 1,520 mm gauge networks in Europe, the Baltic and CIS states, and Russia.

Here we see the considerable difference in appearance between a 2,900 mm wide FLIRT built for European 1,435 mm gauge track, a 3,200 mm wide Finnish 1,524 mm gauge FLIRT and a 3,500 mm wide, 1,520 mm gauge Estonian FLIRT.
services operating out of Helsinki, as we can see from the following anticipated data for future years:
- in 2012 40 % km services operated by FLIRTs and 60 % of all departures,
- in 2013 84 % km services operated by FLIRTs and 75 % of all departures,
- in 2014 80 % km services operated by FLIRTs and 87 % of all departures,
- in 2015 87 % km services operated by FLIRTs and 90 % of all departures.

Starting at the end of 2013, it is envisaged to have the class Sm5s operating all weekend services. The Helsinki suburban rail network is 81 km long, on weekdays 753 services are operated. There are four route groups:
- Helsinki to Karjaa, with short workings to Kirkkonummi and Kauklahti,
- Helsinki to Vantaankoski,
- Helsinki to Riihimäki, with short workings to Tikkurila and Kerava,
- Helsinki to Lahti.

Between Helsinki and the first junction at Pasila, all trains share the same route, with departures from Helsinki at peak periods every four to six minutes! Every day around 176,000 passengers use the suburban services, average trip length is 9.6 km, and average journey time 12.4 minutes. The trains average between 40 and 60 km/h.

Into Belarus...

The Sm5s served as a springboard for Stadler into genuine 1,520 mm gauge territory - in other words, the former Soviet countries. In March 2010 BCh ordered ten four-car FLIRTs, six Class EPG EMUs for suburban services and four Class EP R EMUs for inter-regional services (see R 4/11, pp. 60 - 67). To enable speedy deliveries, the Belarus FLIRTs were almost identical to the Finnish Class Sm5s, and in February 2011 EPG-001 arrived in Belarus. The first three trains were able to enter test commercial service in July 2011. EPR-001 arrived in Belarus in September 2011 and in November that year entered commercial service. EPR-004 was put into commercial service in March 2012.

The second chapter in Stadler’s involvement in the Belarus market was written on 4 October 2012, when at Fanipol, in the southwest suburbs of Minsk, representatives from Stadler, Belkommunmash and the Minsk and regional municipalities laid the foundation stone for a new factory for a joint venture which was originally intended to be known as Elektricheski Transport. However it will be called Stadler Minsk, since the joint venture was created by Stadler (with a 60 % share) and a „Regional committee of Minsk Municipality“. Around 150 employees will be employed initially, and completion is scheduled for late 2013.

This was the very first time that a Stadler-built train visited Russia. One of the EPG FLIRTs, becoming a new face of Belarus railways, was sent to the EXPO 1520 trade fair, which took place at the Shcherbinka test circuit between 7 and 10 September 2011. In the left background is ChS4-373.
The establishment is to be equipped for the production of EMUs and DRAMs for suburban and interregional services, and also for the possible construction of batches of trams and metro trains. With Bekom munnshah being very active in troll ey bu s construction, it is even envisaged that these vehicles might be built there using some Swiss technologies. The factory is a significant move. The cost of around 6 million EUR per FLIRT EMU is a high one for an evolving post-Soviet economy, in spite of the undeniable high quality of the end product. With Bch keen to modernise its fleet of passenger trains, and offer attractive services, a workable form of collaboration had to be devised.

On 6 December 2012 Bch placed a second order with Stadler, for six Class EPR EMUs. These new interregional trains will have five-cars on account of increasing passenger patronage in FLIR Ts. They will be 92,790 mm in length over couplings, fitted with 303 seats, and have a total capacity of 672 passengers, whereas the existing 303 seats, and have a total capacity of 216 seats and 803 passengers, whereas the existing Class EPR EMUs have 216 seats and 672 passengers, whereas the existing Class EPR EMUs have 216 seats and 672 passengers, whereas the existing Class EPR EMUs have 216 seats and 672 passengers.

Aeroexpress shuttle services linking Moscow with the capital’s three major airports, Sheremetyevo, Domodedovo and Vnukovo, and also for the possible construction of batches of trams and metro trains. With Bekom munnshah being very active in troll ey bu s construction, it is even envisaged that these vehicles might be built there using some Swiss technologies. The factory is a significant move. The cost of around 6 million EUR per FLIRT EMU is a high one for an evolving post-Soviet economy, in spite of the undeniable high quality of the end product. With Bch keen to modernise its fleet of passenger trains, and offer attractive services, a workable form of collaboration had to be devised.

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Field-proven, high-performing traction systems?

Certainly.

For Stadler Rail’s single and double-deck multiple unit trains in Central and Eastern Europe, ABB supplies the most advanced traction system technology. Whether the trains run under 3kV DC or 25 kV AC catenary, with Diesel-Electric or dual mode systems, ABB propulsion provides high reliability and energy-efficiency as well as low life-cycle cost. Interested to learn more about our projects and deliveries?

www.abb.com/railway
and Vnukovo. The option clause in the contract envisages a further 13 trains (60 cars). Aeroexpress services are growing rapidly in popularity, and the only way to cater for the demand - and to cope with the growing constraints on infrastructure capacity - is to opt for the use of double deck stock. It is reckoned that the new EMUs will create an increase in Aeroexpress’s fleet’s carrying capacity by between 30 and 40%. Following the arrival of the new trains, Aeroexpress plans to move its older EMUs to one of its other operations, but has not yet decided on which.

This is Stadler’s second contract in Russia, following the GTW+ power modules for the RZD DMUs. It is worth mentioning that the new Aeroexpress EMUs will be the second type of new double deck stock being developed for Russia. Double-deck cars and EMUs are already being developed for RZD by Alstom and TMH. Moreover, with Aeroexpress, this is a second operator to be exploiting double-deck trains in Russia (although one of the operator’s shareholders is RZD).

The Aeroexpress double-deck EMUs will have a top service speed of 160 km/h, and will have a power rating of 6 MW. Their design will be based on that of the KISS, and they will incorporate asynchronous traction equipment, with tried-and-tested ABB traction converters and traction motors supplied by TSA. Their design will be tailored to meet the demands of Russian climatic extremes, for operation in a temperature range from -50 to +40 °C. Experience from the FLIRTs built for the severe winter climates of Finland, Norway, Estonia and Belarus will be incorporated in the design.

The bodyshells will be made of lightweight aluminium, but will be significantly larger than those of European double-deck cars: the 1,435 mm gauge KISSes are 2,800 mm wide and 4,500 mm high, the Aeroexpress trains will be 3,400 mm wide and stand 5,240 mm above rail top. Two accommodation classes will be offered, Business and Economy, with comfortable, bright interior furnishings. Deliveries are to run from early 2015 until late 2016. Construction will take place partly in Switzerland and partly at Stadler’s new factory in Minsk.

Jaromír Pernička using Stadler sources and information of Yrjö Judström/Junakalusto
Photos by author, diagrams by Stadler

Stadler has also recently entered the market for metro trains, with a contract awarded by Berliner Verkehrsbetriebe (see R 4/12, p. 26). This specifies two pre-production Type IK trains (shown in the photomontage), and an option clause for a batch of 34.

Stadler is also expanding its range of 1,435 mm gauge trains. One project is the IC FLIRT. This is a third generation of the FLIRT EMU, which was originally developed for local and suburban services with a maximum speed of 160 km/h. A second generation was the IR/IC FLIRT with a maximum speed of between 160 and 200 km/h (characterised by NSB FLIRT EMUs). The IC FLIRT will be a Class 2 vehicle, with a maximum service speed of 249 km/h.

This is the first time that Stadler will have created a train designed for carrying passengers at speeds in excess of 200 km/h. It was resolved not to take one step further, into the 250 to 350 km/h speed range (Class 1 vehicles), since this is a very specialised category, involving relatively small markets and very sophisticated technologies. Moreover, only a limited number of countries have rail networks designed for trains capable of these speeds.

The IC FLIRT will emerge with a redesigned front end. It will also feature comfortable passenger accommodation, suitable for longer journeys. The technical enhancements will include a dining car and various optimisations to carry handicapped passengers. 3 kV DC, 15 and 25 kV AC versions, and multi-voltage versions will be available. Trains of up to ten cars in length are envisaged, with a maximum power rating of 6 MW. The IC FLIRT is very close to becoming a reality - it will be offered on the market from 2013.
Powerful DMU Traction Converter For Russia

Stadler Rail’s GTW+ modules for the Russian fleet of new DMUs require a new type of diesel-electric propulsion converters. This compact converter, BORDLINE® CC1500 DE, extends the power range of the classical ABB BORDLINE® CC750 DE of which more than 450 units are in operation in many European countries and in the USA.

Global References

Stadler Rail and ABB cooperate for GTW type DMUs since 2003. More than 220 of such trains are in reliable operation in Austria, Germany, Italy, the Netherlands and the United States. The same converter platform has also been used for diesel-electric shunting locomotives in Switzerland and Spain and some rack rail DMUs in Greece.

This platform has now been expanded to two new converter types with higher power and still higher compactness: one type is used for diesel-electric FLIRTs in Estonia (see R 5/12, p. 27), driving each two traction motors instead of one. The other type, BORDLINE® CC1500 DE, is discussed here, driving up to four traction motors and providing higher on-board power for the longer Russian trains.

Traction System Overview

The GTW+ modules contain a diesel engine which drives an asynchronous generator, supplying 500 to 1,200 V input voltage to the BORDLINE® CC1500 DE Compact Converters. The latter contains an active rectifier, two independent motor inverters, a high-power auxiliary converter, and two braking choppers connected to the braking resistors. Each motor inverter can drive one or two motors. The auxiliary converters feed the 3-phase 50 Hz 400 V train power supply line through a sine filter and an auxiliary transformer.

ABB Compact Converter BORDLINE® CC1500 DE

Apart for their reliability, ABB traction converters are known for their compactness and high integration, their modular design, and easy maintenance. They are efficiently water-cooled, resulting in long lifetime of all the components and small converter size. The coolant (regular tap water with glycol) dissipates energy through an external heat exchanger. The cabinet of the BORDLINE® CC1500 DE is a rugged, traction-proven IP54 housing. The control module is mounted on a swing frame in front of the power modules, providing excellent accessibility of all key components. The converter complies with the Russian GOST standards.

Integrated Auxiliary Converter/Head-End Power

The auxiliary converter generates a current limited three-phase output voltage directly from the DC-link voltage.

For the train power supply line, each auxiliary converter provides 300 kVA “head-end power”. A sine filter evens the PWM modulated output voltage, so that a sine wave voltage waveform is available which is transformed to 400 V output. The auxiliary converters of two BORDLINE® CC1500 DE converters can be synchronized without the need of any control signal exchange between the BORDLINE® CC1500 DE units.

Converter Control System

Reliability, speed, and precision require a powerful control unit. The ABB high-end control platform AC 800PEC is used in all ABB traction converters, as well as in a wide range of industrial applications. This unit covers all control and protection functions, sensor inputs, diagnostics and it provides a simple interface to the vehicle control.

In cooperation with the train control management system, standard ABB software modules control for example the slip-slide-functionality, or enhanced electrical braking mode. Modular visual programming ensures quick, reliable coding and easy adaptation of the control software. This leads to fast and flexible engineering for tailor-made solutions in customer projects.

Harald Hepp

Photo and drawing: ABB

**Principal Technical Data**

**Of BORDLINE® CC1500 DE_D_M_1400 Converter:**

<table>
<thead>
<tr>
<th>Generator Voltage</th>
<th>3 x 470 to 1,200 V/23 - 60 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propulsion Output</td>
<td>3 x 0 to 1,250 V AC, 2 x 800 kW at wheel</td>
</tr>
<tr>
<td>Braking Chopper</td>
<td>2 x 700 kW</td>
</tr>
<tr>
<td>Head-End Power Supply</td>
<td>3 x 400 V/50 Hz, 300 kW</td>
</tr>
<tr>
<td>Vehicle Control Interface</td>
<td>Can Open</td>
</tr>
<tr>
<td>Dimensions (W x L x H)</td>
<td>1,394 x 900 x 2,055 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>1,200 kg</td>
</tr>
</tbody>
</table>

### Block diagram of a BORDLINE® CC1500 DE Compact Converter.