

# First Complete Giruno Presented

**On 18 May 2017 Stadler and SBB presented the first complete 11-car Giruno EMU. Attending the event were Doris Leuthard, the President of the Swiss Confederation, and about 500 other guests. In October 2014 SBB ordered 29 of these trains, reserving an option for a further 92.**

For Stadler this was a highly significant event. Following just two and a half years of development, it has its first complete high speed train, **RABe 501 001**, on the rails, undergoing testing. Simul-

taneously, Stadler combined this presentation with a start of celebration of the 75th anniversary of the company's founding.

The first Class RABe 501 Giruno EMU was exhibited for the very first time at InnoTrans 2016 (see R 5/16, p. 36). This was a shortened formation, of only

five cars. All the remaining cars were completed during January and February 2017 and sent to Stadler's IBS commissioning centre in Erlen (see R 1/17, p. 22). The 11-car formation was created there on 23 March 2017.

Soon afterwards, on 28 March, the Bundesamt für Verkehr (BAV) issued

a licence permitting testing of the 11-car train on the SBB network. The first test run took place on 28 April on the line between Sulgen and Romanshorn.



## Authorisation Starts

18 May 2017 was also the date selected for the start of the official programme of authorisation testing for the Giruno in Switzerland. RABe 501 001 will be joined by another train to share the tests in **Switzerland**. Four more will be used for authorisation testing in Germany, Austria and Italy. All six Girunos will be drafted into use for testing by January 2018. The tests in Germany and Austria are scheduled to start in October 2017, with testing in Italy starting in February 2018.

The Girunos are triple voltage (15 and 25 kV AC and 3 kV DC) EMUs. They will be authorised for the whole of the Swiss 1,435 mm gauge network electrified at 15 kV 16.7 Hz. Within that a new interim directive, valid from 2014, will also be taken into account for tests on lines where there are curves with a radius of under 250 m (referred to as „test range 5“). Test runs will also be made through the long trans-Alpine tunnels - the Gotthard and Lötschberg Base Tunnels. The Girunos will also be tested on the urban Durchmesserlinie in Zürich (see R 3/14, p. 7), which has a maximum gradient of 37 ‰.

The objective of testing in **Germany** will be to obtain authorisation for operation on the whole 15 kV 16.7 Hz network. A similar objective is planned for authorisation in **Austria**, with the exception of the sinuous Semmering pass line. Approval in **Italy** is necessary for lines electrified with 3 kV DC and 25 kV 50 Hz. It is anticipated that a Giruno will visit the VUZ Velim test track starting in July 2017 for a series of dynamic tests.

Authorisation tests are expected to occupy around 18 months, so that by August 2018 the railway authorities in Switzerland, Germany and Austria will be processing the paperwork generated.

Stadler has appointed five engineers to manage the entire authorisation procedure, and the following **bodies** are involved in the project:

- Notified Body (NoBo) - Sconrail,
  - Designated Body (DeBo) - AEBt in Germany, Switzerland and Austria, and RINA Services in Italy.
  - Assessment Body (AsBo) for compliance with the CSM (Common Safety Method) - AEBt,
  - detailed evaluation of interfaces and an analysis of internal cooperation between the authorisation ranges - AEBt.
- Prose will realise the pantograph measurements in Switzerland. These

*This photo shows RABe 501 001 at Oppikon, near Bussnang, on 18 May 2017. Note the extremely smooth roof covering on all the cars, significantly enhancing the aerodynamic properties of the train.*

Photo: Sven Klein



SBB decided to name its new batch of Class RABe 501 EMUs „Giruno“ (the „g“ being „soft“ as in „giraffe“), the Rhaeto-Romansh name for the common buzzard, referring to the speed of the new trains. **This wood carving was handed over to SBB CEO Andreas Meyer. The wording below the carving „Der Giruno ist flügge“ means „The buzzard is ready to fly“.** The new trains will also be named individually after the Swiss cantons, of which there are nowadays 23, but three of them are divided into half-cantons, giving 26 names. To make up the difference, three of the trains, RABe 501 024, 025 and 026, will be called Gotthard, Ceneri and Simplon, after the mountains under they will pass using new tunnels, making 29 names in all.





The area coloured red in the upper general arrangement diagram of part of the Class RABe 501 shows the generous unbroken space - over 40 m in length - that can be transited by wheelchair-bound passengers. There are also five places where a wheelchair can be turned round. The right-hand diagram shows how a level entrance/exit to the train is achieved within this area, when calling at stations with platform heights of either 550 mm or 760 mm above rail top. This refers to the situation in car H, shown in the lower left-hand photo.



are expected to start in September 2017. Moreover, Prose is participating in the tender for these measurements in Italy.

Stadler has established several **levels** of activities as part of the authorisation procedure, which involves the assessment and confirmation of around 5,000 criteria:

- long term regular coordination with both the NoBo (for TSI approvals) and the DeBos,
- quarterly consultations with both the national authorities and the network access authorities,
- half-yearly coordination meetings of the managing committee for approval with all the relevant railway approval authorities, and the NoBo and DeBos.

Stadler expects authorisation to be **granted** for use of the Girunos in Switzerland, Germany, Austria and Italy by March 2019. This will enable the start of deliveries of the batch-built trains. However, as in the case of its FV-Dosto EMUs (see R 2/17, p. 9 and p. 49 of this magazine) SBB has stated that it is „not prepared to subject its passengers to experiments, and the first priority is high quality“. On account of this, during the first half of 2019 the Girunos are to be tested thoroughly by SBB. On the basis of these tests any necessary modifications will be made, and the first trains will then be put into test commercial service, initially without being allocated to any specific diagrams.

Then in December 2019 it is planned to put the Class RABe 501 EMUs into **regular service** between Switzer-

land and Italy, routed via the Gotthard Base Tunnel. By the end of 2020 they will also be able to use the Monte Ceneri Base Tunnel. SBB is to realise maintenance of the trains using its own staff and facilities, as announced on 30 October 2015. They are to be based mainly at Basel and also at Zürich depots for this purpose.

### Principal Design Characteristics

During the design and development of the Class RABe 501 Stadler used a selection of design structural elements and concepts which over the years have been incorporated and tried and tested in the FLIRT family. The Girunos are fully pressurised, this involving the pressure-tight design of bodyshells, window frames, entrance doors, inter-car gangways and air conditioning systems. On each end car of the train, exterior sensors for measuring external air pressure increases are fitted.

The 11-car formation has a 2' Bo' Bo' 2' 2' 2' 2' Bo' Bo' 2' 2' 2' axle arrangement. When operating off 25 and 15 kV AC and 3 kV DC the one-hour power ratings achievable are, respectively 6,000, 5,400 and 4,800 kW. Under AC catenary the continuous rating is 4,720 kW, while under 3 kV DC it falls to 3,920 kW. The starting tractive effort can be as high as 300 kN.

The 6 MW multiple-voltage **traction equipment** was designed by ABB and meets various requirements. A Type BORDLINE CC1500 MS com-



The interior of car F. Here the entrance doors have a threshold height of 765 mm above rail top. The short corridor to the left of the wheelchair-accessible WC cubicle is of sufficient width for a wheelchair. In the background on the left it is just possible to see the other entrance vestibule, in which the threshold height is 567 mm above rail top. The difference in height between the two entrance vestibules is achieved by means of the aisle being gently sloping. All entrance doors are fitted with CCTV and passenger counters. As necessary, information relating to passenger numbers in each car, and the number of seats occupied, is provided on the exterior text panels, for the benefit of passengers about to board.



The restaurant car (G) has 15 seats, plus two spaces for wheelchairs. The bar (shown in close-up below) is at the far end.

The aisle in the bar area in car G is designed with sufficient space for a wheelchair user to turn round in.



First class car A5 501 (car H) in reality, showing the difference in threshold height of the two entrance doors. Car G (the restaurant) is on the left.

Photo: Sven Klein



There are four first class cars, with a total of 177 first class seats in 2 + 1 configuration with a spacing of 2,040 mm between seat backs.

compact traction converters, with a height of only 400 mm, as well as the Type LOT 3000 traction transformers are mounted underfloor and allow for a maximum seating capacity. Each Giruno is equipped with two traction packages, each comprising one traction transformer, two traction converters and the latest generation Type BORDLINE BC highly compact battery chargers built with silicium carbide power semiconductors.

The individual cars are designated from A to L, with I being omitted. This designation will also be used by SBB, with every car also having a UIC number. The entire formation is composed as follows:

- end car L, first class (Class At2 1 501),
- intermediate first class cars H, J and K (Class A3 501 to A5 501),
- dining car G (Class WR 6),
- intermediate second class cars B, C, D, E and F (Classes B7 501 to B11 501),
- end car A, second class (Class Bt1 1 501).

The Class RABe 501 is fitted with four pantographs. There are two on cars B and D, designed for use in Switzerland and Italy. These have a skid width of 1,450 mm. Cars F and H have remaining two pantographs, with a skid width of 1,950 mm, for use in Germany and Austria. The traction equipment is situated in cars C, E, J and K. It is possible to operate two Class RABe 501 EMUs in multiple.

An 11-car formation is 201.6 m long over couplings, and with these concealed behind flaps, 202 m long. Tare weight is 388.3 t, with a maximum permitted gross laden weight (with standees at a density of four per m<sup>2</sup>) of 454 t. The bodysells of the end cars are 22,250 mm long, those of the intermediate cars 17,500 mm. The distance between bogie pivots of the end cars is 16,700 mm, and that of the intermediate cars is 17,500 mm, since the latter are articulated, mounted on Jakobs bogies, which have a wheelbase of 2,750 mm. The wheelbase of the non-powered bogies at the outer ends of the end cars is 2,700 mm. All wheels have a diameter of 920 mm when new, wearing to a minimum of 840 mm. All cars have a maximum width of 2,900 mm and a height above rail top of 4,255 mm, with pantographs lowered.

The train has a total seating capacity of 405, with 117 seats in first class and 288 in second. There are also 17 seats in the dining car and two wheelchair spaces in first class, with two more in second class.

Stadler's main challenge in developing the Giruno lay in meeting the exacting standards specified by the Swiss Behindertengleichstellungsgesetz (BehiG), the legislation applying to access requirements to buildings or public transport vehicles for handicapped persons. This was one of the reasons which the deliveries of the FV-Dosto EMUs have been delayed.



The six second class cars have a total of 288 seats, in 2 + 2 configuration, a mix of rows and bays. In the bays the distance between seat backs is 1,850 mm, while in the rows it is 860 mm. The cars B, D, E and J have multi-purpose areas designed for the storage of prams and in the car C is space for four bikes. **This is the interior of car E, which is designed for families travelling with small children.** Note the table tops are designed for games and the interior sidewalls have Swiss-themed decoration.

The BehiG legislation was introduced on 1 January 2004. One of the paragraphs in the documentation states: „Disabled persons are placed at a disadvantage if, for reasons of design, barrier-free access to buildings, including residential apartments and offices, and public transport vehicles, is made more difficult or even impossible.“ By 2024 all handicapped persons must be guaranteed barrier-free access to residential apartments, public buildings and public transport.

To meet BehiG requirements, it was decided to create an area, over 40 m long, in cars H (first class), car G (dining) and car F (second class) which is **barrier-free** for handicapped passengers. This ensures that wheelchair-bound passengers are able to move from the wheelchair harness points in first and second class cars which are equipped with wheelchair-accessible WC cubicles to the dining car.

The entrance door thresholds in cars H and F are at different heights above



The galley has stainless steel furnishings, and is equipped for the preparation of hot meals.

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A unique feature on board the Giruno EMU is the provision of separate WC facilities for ladies and gentlemen, this requested by SBB. In cars B, D and K, there are sets of three cubicles. Two have a standard WC and washbasin (see left-hand photo), one for ladies, one for all, while the third has a urinal and washbasin, for gentlemen. Cars F and H each have a large wheelchair-accessible WC cubicle, while car H has a staff WC cubicle.

rail top, to ensure barrier-free access to and from platforms of different heights, the aisles in these cars having a slope of 12 % between the two entrance vestibules. In other cars the aisles are slightly steeper, at up to 15 %. The most length of the train is step-free, with a maximum floor height either 1,080 or 1,150 mm above rail top over the Jakobs bogies, and 1,200 mm above the end bogies. Near the inter-car gangways it is necessary to mount the seat units on low raised floor sections, and access to these seats is by means of shallow steps from the aisle.

The aisle, where it is designed for wheelchair use, is 800 mm wide, and elsewhere has a minimum width of 520 mm (in first class 560 mm). The headroom varies from a maximum of 2,449 mm to a minimum (near the inter-car gangways above the Jakobs bogies)

of 2,000 mm. In the inter-car gangways the headroom is 2,220 mm.

The train has 15 single-leaf entrance doors on each side, of which 12 are for use by passengers boarding and alighting. The door configuration is as follows:

- car G, the dining car, situated roughly in the middle of the train, has one catering door on each sidewall. These doors are close to the galley, and are intended for loading stores. They can also be used as emergency exits. Otherwise the only access to car G is from adjacent cars.
- cars H and F, at either end of car G. They have two 900 mm wide entrance doors on each side. The entrance doors closest to car G have a threshold height above rail top of 567 mm thus facilitating wheelchair access from Swiss station platforms which are

Interior movements of passengers within the train are documented by means of sensors (the black rectangles in the ceiling) in the inter-car gangways, visible in this photo. On the left of the gangway there is also a CCTV camera (the black rectangle). Data from these are transmitted to the exterior text panels, to provide passengers about to board with information on car occupancy. It is technically possible to show information on seat occupancy as well, indicating how many non-reserved vacant seats there are, but this has not yet been implemented. This photo also shows the slight gradient of the centre aisle, between entrance vestibules with thresholds of different heights. Some seat units are positioned on ledges slightly higher than the aisle.



Car C (second class) has an area designed for the carriage of up to four bikes. There are two bike holders on each side of the aisle. There is also a rack for large items of luggage, while the shelves of this can alternatively be used for the vertical stacking of skis and snowboards.

The lower photo of SBB's first Class RABe 501 11-car Giruno EMU was taken during a test run on 16 May 2017 between Sulgen and Erlen, on the line from Sulgen to Romanshorn. In the background is visible Stadler's IBS competence and commissioning centre in Erlen.

Photo: Daniel Wipf





The layout of the driving console follows the tried-and-tested configuration used in FLIRT and KISS EMUs.

550 mm above rail top. These platforms are referred to in Switzerland as „P55“, the height being given in cm. The entrance doors in the other vestibule have a threshold height of 765 mm above rail top, ensuring barrier-free access from platforms in Germany, and referred to as „P76“.

- the other eight cars have two entrance doors, one on each side, the threshold height at all of these being 765 mm above rail top,
- the end cars also have independent entrance doors accessing the driver's cabs.

Within the entrance vestibules, the floor height is a standard 880 mm where the thresholds are 765 mm above rail top, while it is 682 mm in the two entrance vestibules where the threshold height is 567 mm.

The wheelchair-accessible area in the centre of the train has two wheel-

chair-accessible **WC** cubicles, one in car H, the other in car F. Car H has a staff WC cubicle. In the remainder of the train there are nine standard size WC cubicles. Three of these are for ladies, three for ladies and gentlemen (with a WC) and three for gentlemen (with only a urinal).

All cars are provided with ample luggage racks, at-seat power sockets, and LED illumination. In the lengthy Alpine base tunnels signal transmitters are provided throughout to enable access to 3G and 4G networks, so signal amplifiers for these transmitters are provided, together with reception devices for WiFi internet.

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*Photos, unless cited,  
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*Diagrams: Stadler*



In second class car D a compartment is provided as an office for the train manager. There are also two displays. The one, nearest the window, is used for the train manager's broadcasting station, containing communication equipment. The second one provides the train manager with information about ATP and ETCS. The train manager thus can read certain information but is not able to intervene in the operation of the train. He can, however, forward the information to those who may need it.



Four cars destined for the third Giruno in the final assembly hall at the Bussnang works on 18 May 2017. The bodyshells are made of aluminium. When batch production starts up, one Class RABe 501 will take around 30 weeks to build, from start to finish.

*Photo: Peider Trippi*

The presentation of the Giruno EMU formed the centrepiece of Stadler's celebrations of its **75th anniversary**. In 1942 Ernst Stadler founded an engineering company in Zürich, specialising in locomotive development and construction. In 1962 he moved the company to Bussnang in Thurgau canton, thus establishing the future location of Stadler Rail's headquarters. Then in 1987 Peter Spuhler joined the company, buying it up outright in 1989 with a bank loan. At that time Stadler was only a small company, with just 18 employees and a modest annual turnover of 4.5 million CHF. By 2016 it had grown impressively, with a workforce of over 7,000 based in various factories and maintenance establishments in Switzerland, Germany, Spain, Poland, Hungary, the Czech Republic, Italy, Austria, the Netherlands, Belarus, Algeria and the United States, and with an annual turnover of 2 billion CHF.

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