

GNSS Live Tracking for Cycling Fans

by Thomas Aigner

The annual Bayern Rundfahrt, or Tour of Bavaria, (www.bayern-rundfahrt.com) is Germany's largest professional stage race. This year the Regional Surveying and Geoinformation Office supported the event with maps, aerial photos, 3D animations and live tracking. With live tracking, GNSS receivers mounted on escort vehicles transmit the co-ordinates of the cyclists at the front and rear of the pack to a centralized service. The positions are displayed on a specially adapted Bavarian Surveying Administration BayernAtlas for cycling fans to track the race conveniently in real time over the Internet.

In 2012, the Bavarian Broadcasting Company's "BR-Radltour" was the first public cycling event the Bavarian Surveying Administration supported with live tracking. To meet the increased needs of the

second live tracking event – the Tour of Bavaria in May 2013 over a distance of 783.5 km (487 mi) – the Bavarian Surveying Administration chose to use more professional instruments. The previously used simple GPS tracking transmitters had difficulties with position accuracy and mobile reception.

Across Bavaria, powerful Leica Geosystems GNSS sensors Viva GS15 and GS10 have been used at 51 Cadastral Offices for satellite-supported measuring tasks in the land registry for several years now. Thus the agency has both experience in using the devices and sufficient instruments which could be provided for the Tour of Bavaria. In addition to the powerful GNSS evaluation hardware, the high-quality mobile antenna accessory promised a more stable connection, even in areas of the state with weak coverage, in comparison to the simple GPS tracking transmitters. Last, but not least, the many options for supplying power, including internal batter-



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ies, external batteries and supply via a 12V vehicle electrical system, guaranteed a flexible and secure solution.

By nature, complex, high-performance systems also place greater demands on the user. The critical question then arose as to whether the selected Leica Viva GS10 receiver would be easy enough to operate during an activity as turbulent as a bicycle race. During the 2012 BR-Radltour, only the very front and rear positions were tracked, but for the 2013 Tour of Bavaria, the position of the peloton (main group of cyclists) also had to be visible as a third position, should some cycling pros successfully manage an exciting leap ahead of the pack.

The three escort vehicles: the police's lead vehicle, the sport physician's vehicle and the event organizer's "sag wagon" were each equipped with a Leica Viva GS10 receiver. Since some of the Bavarian Sur-

veying Administration escort personnel were only available part of the time for the Tour of Bavaria, the instruments had to be operated (set-up, started, power supply monitored) by whoever else was in the vehicle, i.e. inexperienced users. Despite this, reliable functioning had to be ensured.

Orgatour: Successful Equipment Test

In addition to materials, training is an important part of any cyclist's race preparation. Therefore it was possible to put the instruments through their paces in advance of the race. The selected equipment (a Leica AS10 GNSS antenna with a GAT18 GMS/UMTS antenna on the roof and a Leica Viva GS10 receiver with power supply in the car) was tested by the event organizer in May 2013 during a so-called Orgatour, a preparatory exploration of the route. It became evident at this point that the right choice of equipment had been made. The accompanying personnel were able to reliably operate the test instrument after





BayernAtlas

Thanks to the free BayernAtlas from the Bavarian Surveying Administration, free detailed aerial photos, 3D models of buildings as well as topographical and historical maps of Bavaria with much additional information are available to everyone.

www.bayernatlas.de



only ten minutes of instruction. Concerns regarding mobile reception also proved unfounded as the Orgatour progressed.

Only a few position transmission dropouts remained unexplained. To localize their source of error, the two affected stages were travelled again by the Regional Surveying and Geoinformation Office with two Leica Viva GS10 receivers and different mobile provider configurations. This test revealed that, despite the long stages of just under 200 km (124 mi) in hilly and forested terrain, the mobile connection was nearly always reliably maintained by the instrument. In rare cases the connection was lost while transitioning between cells in a weak mobile network. Setting "Automatic Connection" in the Leica SmartWorx Viva field software's RTK profile quickly solved this problem. A nice side effect was that this also reduced operation of the Leica Viva GS10 to a minimum.

Just as with on-site operation, the transmission and processing of position data proved to be surprisingly easy. Since the GNSS rover which calculates the exact position data using the "virtual reference station" RTK concept transfers its current position to

the administration's SAPOS service as an NMEA data record, the position data then only needed to be provided to the BayernAtlas server. Elaborate and error-prone configuration of the network connections on the rover was completely unnecessary. The vehicle positions were collected as a by-product of the SAPOS correction data server and then only had to be filtered out.



■ GSM and GNSS antenna setup



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Good preparation leads to a successful race

Every imaginable preparatory measure for smooth technical support of the race had thus been taken. The day before the first stage, the escort vehicles were outfitted and the occupants were instructed in the operation of the instruments. Although each installation arrangement wasn't yet known and many of the power sources had already been taken up by the tour's mobile needs, the optimum solution was quickly found for each vehicle using either batteries or the vehicle's electrical system. Time-consuming recharging of batteries could even be fully dispensed with, thanks to good advance planning and comprehensive accessories.

Good preparation enabled trouble-free live tracking of the Tour of Bavaria. The only thing worth complaining about was the cold, wet weather during the tour, but even this didn't negatively affect the instruments in any way. Despite constant rain, the equipment served flawlessly and reliably transmitted the position data of the racing cyclists. Subsequent evaluation of the transmitted NMEA data showed that an impressive 75% of all points achieved an RTK accuracy of about 2 cm (0.8 in) and another 24% a

DGPS accuracy of about 1.5 m (4.9 ft) – thus by far exceeding the requirements.

Apart from the technical details, both the tour organizers and many other people interested in the 2013 Tour of Bavaria profited from the Surveying Administration's "live-tracking project". The feedback received was also correspondingly positive. Both visitors to the Bavarian Surveying Administration's information stand at the stage destinations and fans at home were able to track the race's progress live at all times and estimate the cyclists' arrival at the finish line. At the end, the Tour of Bavaria organizers expressed their sincere thanks for the successful project. As far as the Bavarian Surveying Administration is concerned, there is nothing standing in the way of a repeat performance at the 2014 Tour of Bavaria. ■

About the author:

Thomas Aigner is a Surveying Engineer (UAS) at the Bavarian Agency for Surveying and Geographic Information (Landesamt für Vermessung und Geoinformation/LVG) and is responsible for all Cadastral Offices in Bavaria. thomas.aigner@lvg.bayern.de