Global Navigation Satellite Systems (GNSS) are becoming one of the main components supporting Intelligent Transport Systems (ITS) and value-added services in road transport and personal mobility. The use of GNSS is expected to grow significantly due to improvements in positioning performance, with positive impacts such as: finding the optimal route; improving traffic and travel efficiency as well as safety and security; reducing congestion and optimizing fuel consumption. The deployment of many automotive applications, like for instance automated driving, requires highly reliable positioning information. However, the positioning reliability depends strongly on the quality of the GNSS signal, which varies greatly according to the road and operational environment. It is therefore important to specify the GNSS performance requirements for the various road transport applications (Gilliéron, 2016).

“The role of positioning in road applications

The use of surveying instruments and positioning systems, such as GPS receivers, has a long tradition in the road...
construction industry and in particular machine guidance for roadwork and pavement. More recently, the introduction of car navigation systems has allowed drivers to know their position more precisely and to choose the best route to reach their destination on time. Everybody has probably, at some point, been wrongly guided by a car navigation system. Incorrect navigation is usually without serious consequences as drivers are able to detect the misleading information and react appropriately instead of blindly following the instructions of the navigator.

While navigation errors may be acceptable for applications like traffic information or route guidance, this is not the case when the liability or the safety of road users could be impacted. The example in Fig. 1 shows the consequence of positioning error for road user charging (RUC) application. On the one hand, we have an overcharging case with User A being wrongly located in the charging area, and on the other hand we have an undercharging case with User B being wrongly located outside the charging area (Peyret, 2015).

The RUC example demonstrates the necessity of defining the quality of positioning information. The positioning terminal, mainly based on GNSS, must be able to provide to the appropriate level of trust according to the application requirements. If the positioning accuracy is lower than an alert limit defined for the application (eg, RUC), the positioning information message will be discarded. This concept, called positioning integrity, is a performance feature closely linked to the reliability of the systems. Positioning integrity represents the trust level with regard to the position or velocity values delivered by a positioning component (Peyret, 2017).

THE SAPPART COST ACTION
COST is a European framework supporting transnational cooperation among researchers, engineers and scholars across Europe. In this context, a network of European experts has defined a COST Action (TU 1302) within the transport and urban domain called “Satellite Positioning Performance Assessment for Road Transport (SaPPART)”. This Action gathers scientists, industrial and governmental partners from the GNSS com-

“The deployment of autonomous vehicles is becoming a reality on the European road network and will significantly affect the future liability of different actors in the road and transport sectors”
munity and the ITS domain, with the capacity to act for a common goal on the definition of positioning integrity in the road sector. Together, they discuss open issues and have played an important role in supporting standardisation and to underpin certification initiatives. This framework is expected to pave the way for certified positioning terminals, which is expected to result in a significantly accelerated use of GNSS-based ITS and mobility applications (Fig. 2).

GNSS PERFORMANCE REQUIREMENTS IN THE ECALL REGULATION

The European Commission delegated regulation 2017/79 of 12 September 2016 established detailed technical requirements and test procedures for the EC type-approval of motor vehicles with respect to their 112-based eCall in-vehicle systems. Annex VI of the regulation provides: “Technical requirements for compatibility of eCall in-vehicle systems with the positioning services provided by the Galileo and the EGNOS systems”. The requirements concern the GNSS receiver compliance to the protocol format, or performances such as, for instance, position accuracy, time to first fix or sensitivity of the receiver. Additionally the annex provides a detailed description of the test methods.

SaPPART COST action experts participated in the consultation meeting for contributing to the provision of the GNSS performance requirement specification in this first delegated regulation for motor vehicles.

TOWARDS AUTONOMOUS DRIVING

The deployment of autonomous vehicles is becoming a reality on the European road network and will significantly affect the future liability of different actors in the road and transport sectors. Liability is strongly linked with the trust that you can have in a system -- for instance, a vehicle with advanced driver assistance or automatic driving capabilities. In these applications vehicle positioning is one of the most critical components because most of the decisions are based on the location of the vehicle itself and of other vehicles and objects in its vicinity.

In 2017, the SaPPART COST Action will close after four years of work and initiatives. Three deliverables will be available for free on the SaPPART website.

Pierre-Yves Gillieron, Ecole polytechnique fédérale de Lausanne (EPFL), Switzerland
François Peyret, Institut français des sciences et technologies des transports, de l’aménagement et des réseaux (IFSTTAR), Nantes, France
François Fischer, ERTICO, Brussels, Belgium

Pierre-Yves.gillieron@epfl.ch
www.sappart.net

Figure 2: a selection of applications covered by SaPPART

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