Easy-OBU Project

User Requirements (properties of GNSS)

Vienna, 16th of May 2013, Dr. Jörg Pfister

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Easy-OBU research project in a nutshell: GSA supported international project aimed at an introduction of cheap positioning solution with improved accuracy

- **What are we doing:** we are developing and preparing market introduction of a new On-Board-Unit capable of providing more accurate location information in challenging situations (such as tunnels) at low cost
- **Who we are:** an international consortium consisting of EFKON (AT), pwp-ystems (DE), AustriaTech (AT), ITS&S Association (CZ) and ČVUT (CZ)
- **Public support:** the project is partially funded from the 7th Frame Programme of the European Union

This project is funded by the European Union and carried out in the context of the Galileo FP7 R&D programme supervised by the GSA

Ambition of GPS

- **Very accurate Positioning**

  Accuracy of approximately 10m in standalone mode, 3m with EGNOS and down to centimeter range with differential methods (e.g. in geodesy).

- **Global coverage**

  The service can be used all over the world.

- **Full availability**

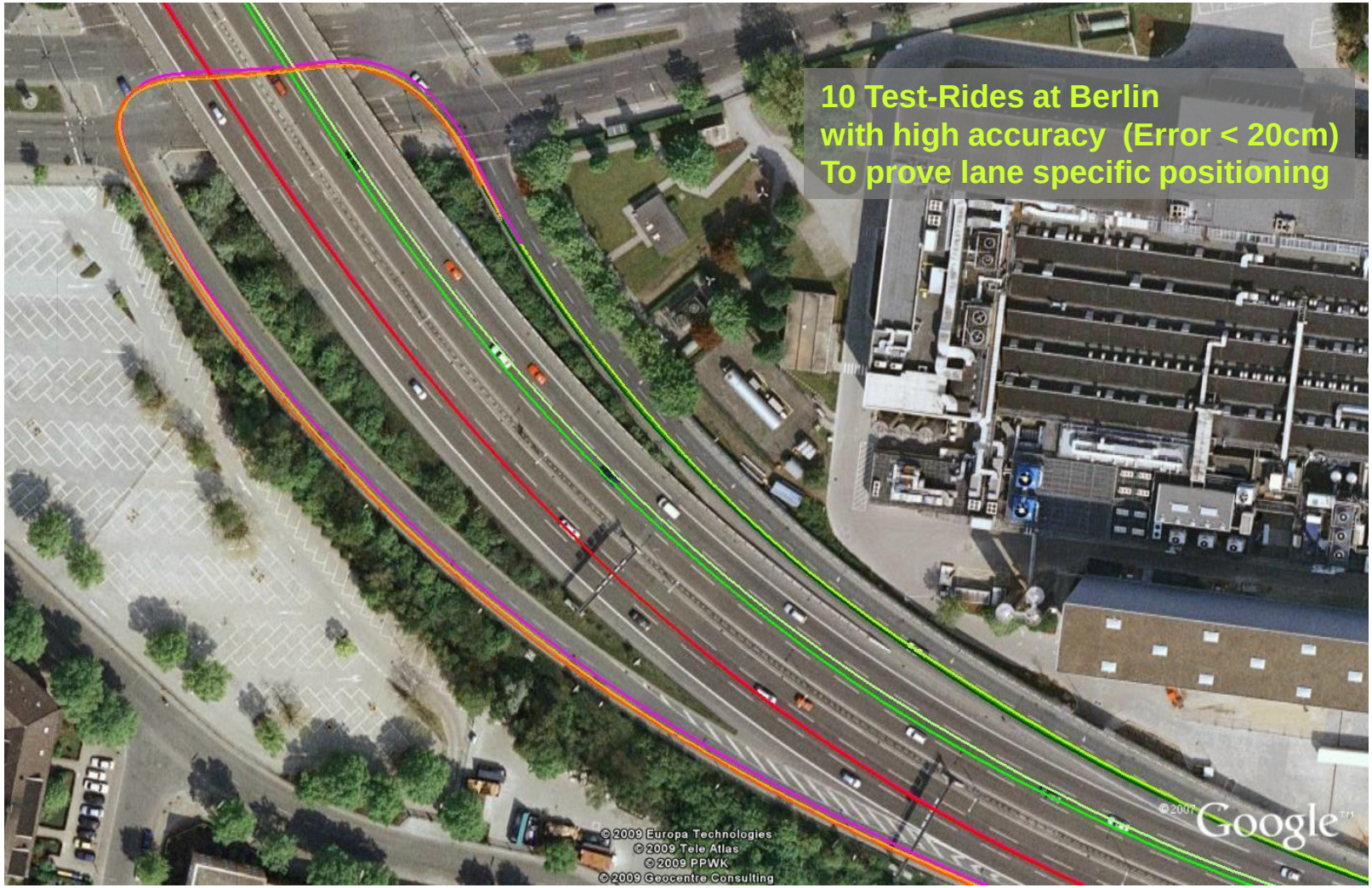
  The service can be used all the time (on a 7/24 basis)

- **Footnote: “Signal in Space”**

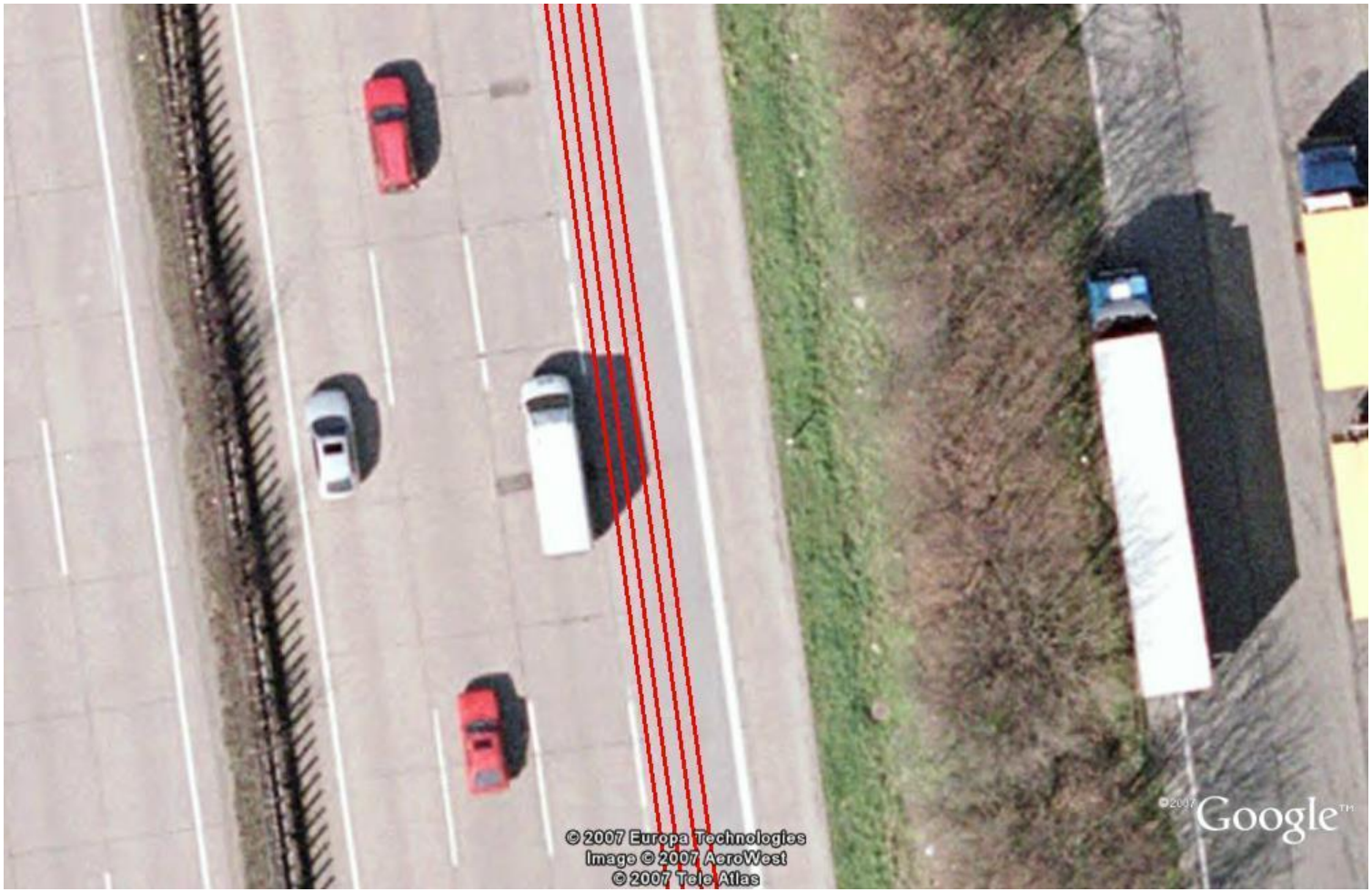
  The above statements refer to ideal world conditions (without terrain, buildings or plants). ➔ But what happens if we apply it for applications in traffic and transport?

Test-Vehicle

Produced References with test vehicle



GPS + EGNOS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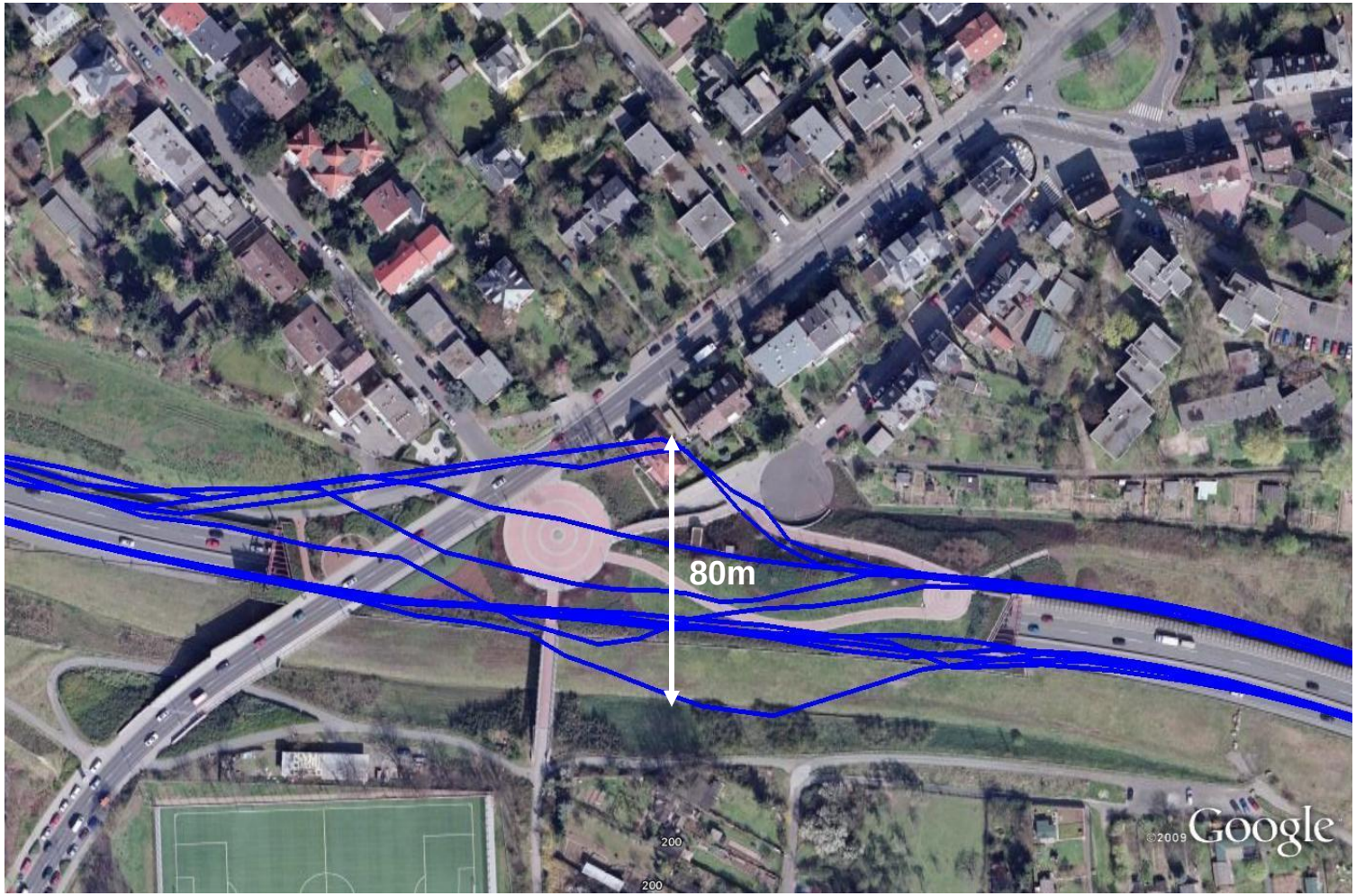
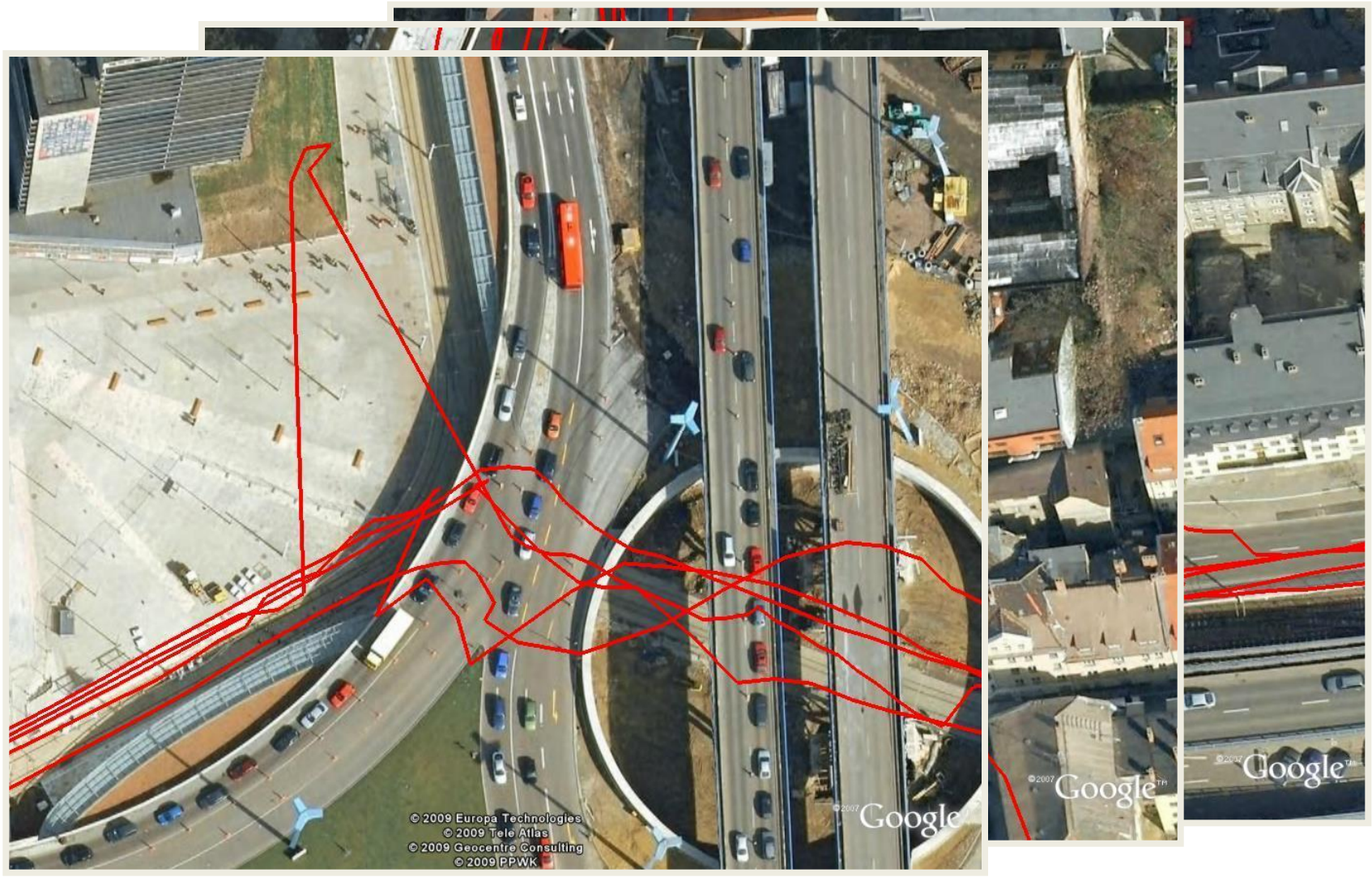
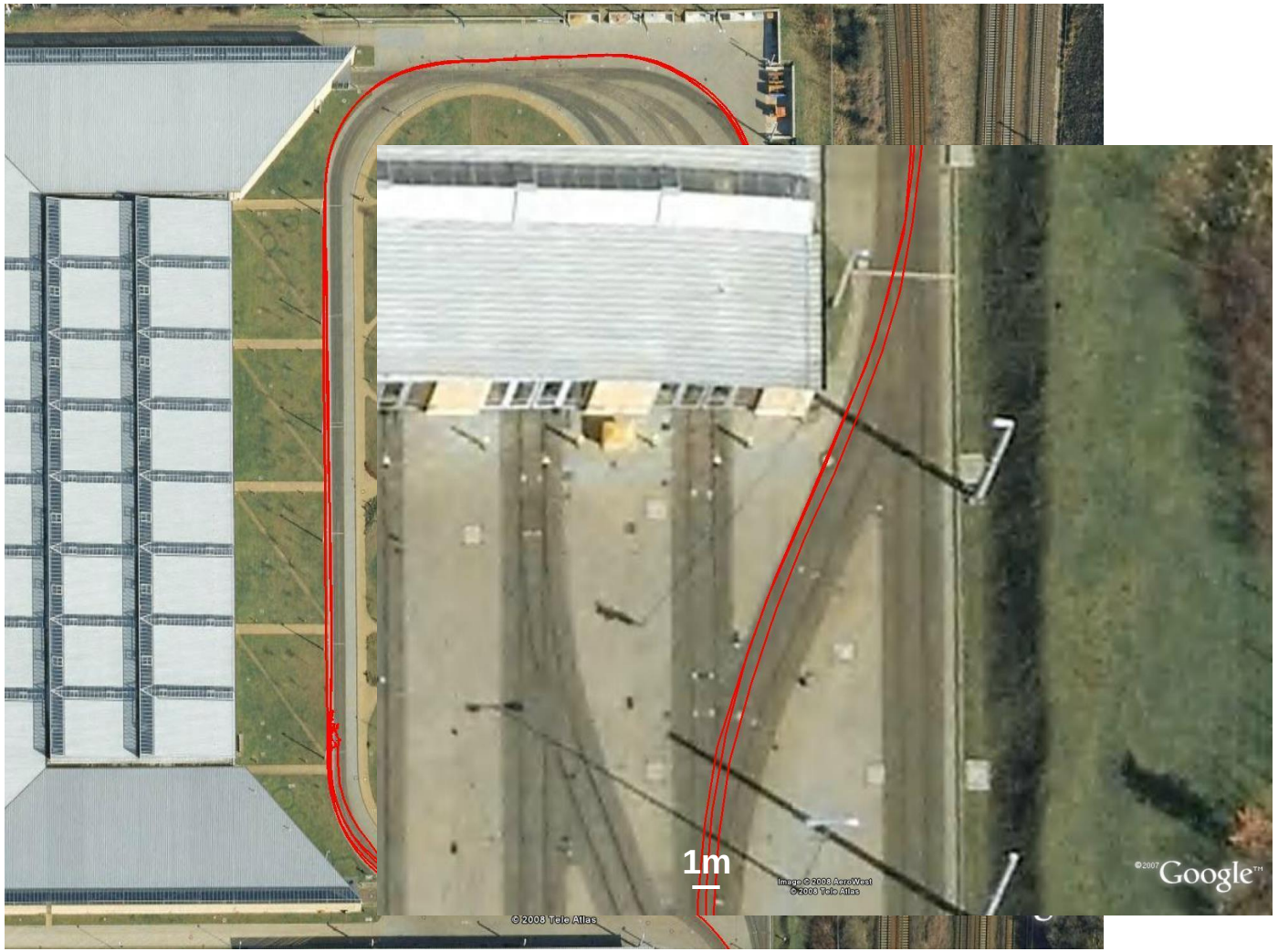
GPS + EGNOS (phenomenon)



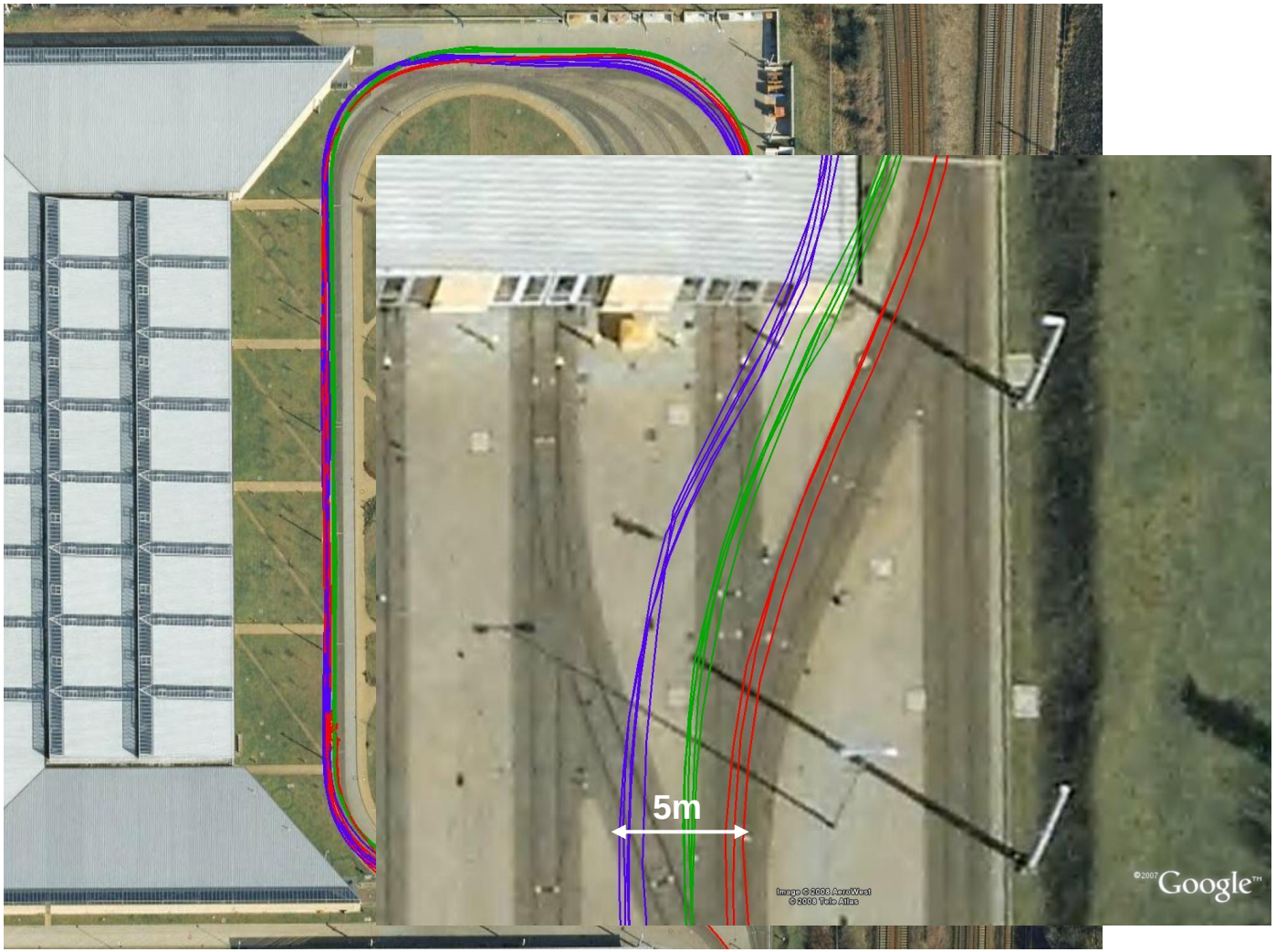
Further GPS phenomenons



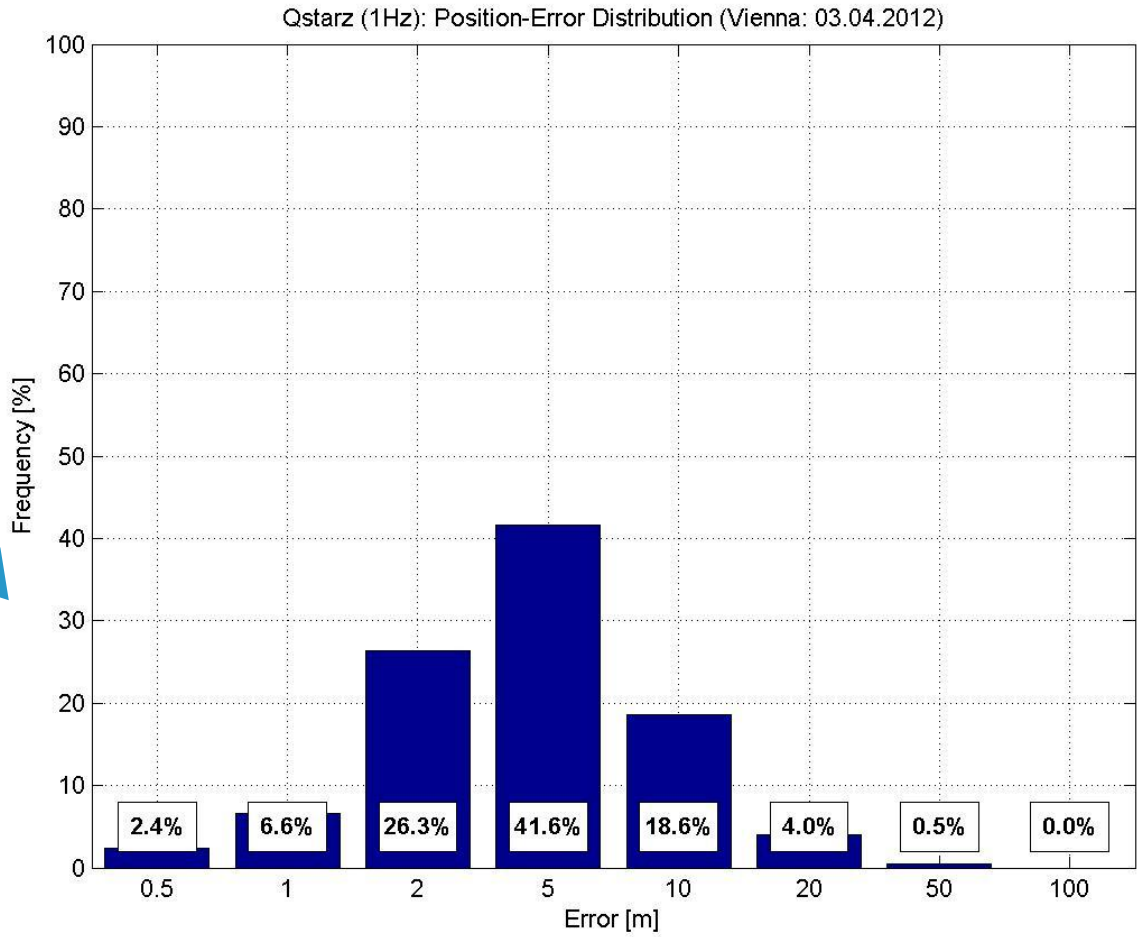
GPS Performance potential



GPS Reproducibility



Histogram as suitable representation for error distribution

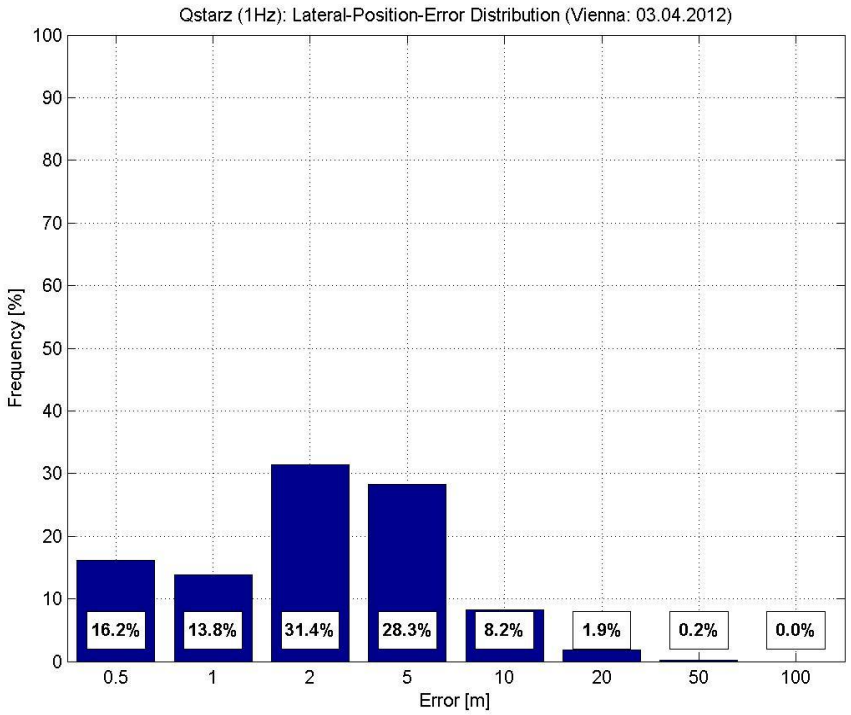


Percentage of device-specific GPS data with distance from reference

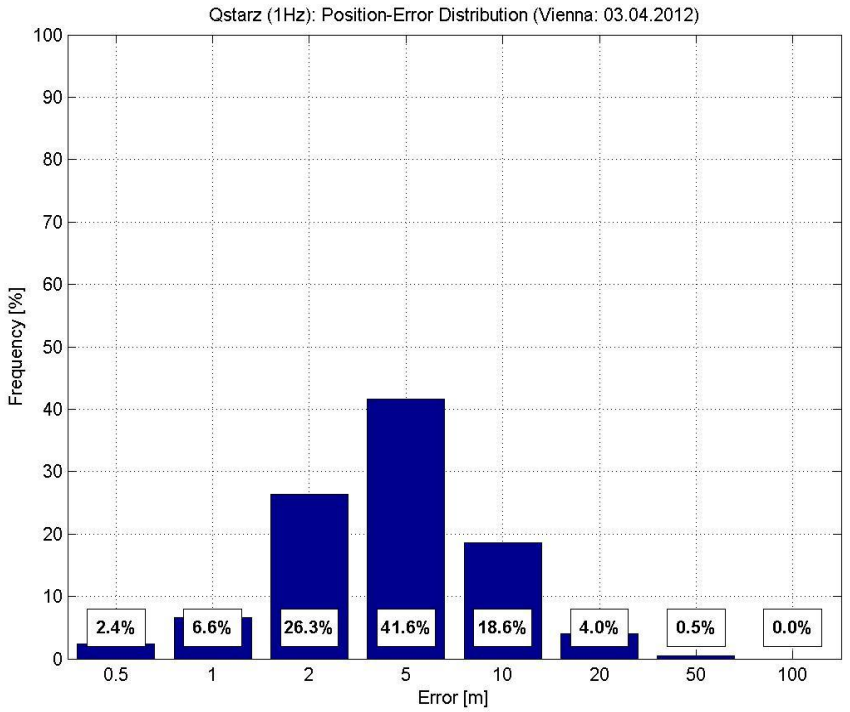
Deviation from reference in meters

Example: error distribution of a Qstarz-GPS-Reciever (1Hz)

Lateral Deviation



Absolute Deviation



Methodology to acquire user requirements

- **Elaboration of information material**
- **Identification of demanding applications**
- **Formulation of user requirements in technical form**
- **Translation of the technical requirements into functions and features**
- **Identification of representative stakeholders**
- **Design of a dedicated questionnaire**
- **Execution of interviews with selected stakeholders**

Possible target applications and identified stakeholder groups

- **Route controlling and proof of service for special vehicle fleets**
- **Car sharing (pay per use);**
- **Electronic toll collection (ETC);**
- **Calculation of CO2 Footprint;**
- **Generation of vehicle logs or pay per use insurance;**
- **Public Transport: performance documentation**

- **Industry (Key industry players including ITS manufacturers)**
- **Infrastructure operators (for road, rail, ITS, etc.)**
- **Fleet operators (with respect to logistics and passenger transport)**
- **Ordering Parties (Government, public owned institutions, cities, etc.)**
- **ICT industry (SME and specialized companies, ICT integrators, telecommunication, services operators)**
- **Financial services (Banking, finance, insurance companies, etc.)**

Elaborated user requirements

- **Availability** **> 99.9 %**
- **Position accuracy:** **< 10 m (CEP_{95})**
- **Heading accuracy:** **< 5 ° (1 sigma)**
- **Velocity accuracy:** **< 2 km/h (1 sigma)**
- **Accuracy of distance travelled** **< 1 %**
- **Time accuracy:** **< 0.5 s (1 sigma)**
- **Update rate:** **1 Hz**

- **Light weight unit in the vehicle**
- **Small in size (the view through the windscreen should not be disturbed)**

Further Insights from the executed interviews

- **90 % use positioning technologies for their operation processes.**

  35 % use GPS standalone

  15 % correct GPS with logical information only

  30 % use a combination of GPS with either one or multiple other technologies, like infrastructure based positioning like transponder or IR-beacon, vehicle speed, etc.)

  10 % use infrastructure based positioning as standalone solution or in combination with either one or multiple other technologies, like vehicle speed, logical positioning, inertial sensors
- **15 % of all interviewees are satisfied with their current solution and don't see benefits from improved position information for their respective application**
- **5 % of all interviewees are satisfied with GPS as standalone solution**
- **10 % of all interviewees are exploring EGNOS for improved positioning**
- **0 % of all interviewees use EDAS so far.**

Ambition of Easy-OBU

- **Overcome the deficiencies of GPS**

  1. Fill the gap during signal outage
  2. Cut on large errors during difficult reception conditions

- **1. Retrospective gap filling**

  for time periods of GNSS outages, Easy-OBU determines the missing position fixes. The result will be stored back in the central server data base and provides enhanced availability with respect to location.

- **2. Compensation of large position errors**

  Low-cost inertial sensors will be used to check the GPS-fixes for plausibility, in order to detect situations with large errors. These errors shall be reduced or even compensated through Easy-OBU and thus improve the overall accuracy.

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