High-end GNSS based Application used for the German Railway Clearance Measuring Train

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International EUPoS® Steering Committee
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Berlin, Germany

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Introduction

Preconditions for high end GNSS based applications (clearance measurement)

- Ground based augmentation systems

- Bidirectional data exchange

- DGNSS based service /GSM/GSMR

- Processing options /on the train or service center

Examples

Conclusions
Participants include vendors, service providers, and government agencies from around the world.

Standards are subjected to performance and interoperability testing prior to adoption and publication.

Achieving compatibility and interoperability - between the service providers - between different manufactures we are able to guaranty the trans border use of positioning and navigation services without any looses.
EUPOS is an common realization of high density reference station networks (single segments)

Common terms of reference and standards for building up and managing the GNSS infrastructure

High redundancy based on additional stations (65-70 km for the 2cm accuracy in real time)

different used signals GPS, GLONASS, GALILEO
Flood and disaster management projects along the Danube river
EUPOS Transmitted correction models

- **FKP** – area modeled corrections
- **VRS** – Virtual Reference Station (non physical ref. station)
- **MAC** – Master Auxiliary Concept
- Using NTRIP Internet Protocol as transport layer from multi casting servers
  - *Worldwide standardized in RTCM version 3.1*
EUPOS Sparse or Dense network design
GPS availability
**EUPOS -** different receivers only GPS and GPS/GLONASS

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ETRS89 based
Quality control
## EUPOS Services

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<td>5 mm</td>
<td>RINEX</td>
<td>Internet</td>
<td>GPS+GLONASS</td>
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<td>RTCM 2.x, RTCM 3.x</td>
<td>GSM, GPRS NTRIP</td>
<td>GPS+GLONASS</td>
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*Based on ETRS89*
Railway spatial Database for rising the infrastructure maintenance performance of the German Railway
Integrity of the railway navigation database
Ambiguity free system determination

Geoid Change
German railway network
High precision corridors
High precision corridors
Client – Server based web application
Client – Server based web application
EUPOS/SAPOS-based Vehicle Scheduling and Control System by the German Railway - RailNav Project

...stable comunication

Source Mr. Lahr DB AG / GEO++ Garbsen

Ivo Milev
International EUPOS® Steering Committee

Dubai, United Arab Emirates, 16 - 20 January 2011
3D clearance measuring train

Measuring trains:
for Wire condition
for Rail head condition

20 HZ GNSS receiver
Video system
High speed laser scanner

Frauenhofer Institute Freiburg

INS System

Frauenhofer Institute Freiburg

i3mainz.fh-mainz.de
DB_VIS the image information set
DB_VIS the image information set
Position related to geocoded maps
Map matching (position, length and scale)
Chainage direction
Curvature elements based on the recorded INS data
Comparison image - scan
LIRA database objects
Generate platform edge – strategy to open the railway market
Conclusions

Preconditions
• 3D spatial data as basis
• GBAS

• Clearance analyzing
• Measurements direct in 3D space, also to clearance gauge (distance, collision simulation)
• Import of old LIRA profiles, add photographs
• Export of captured values = “geo clearance objects” as products