The Goal
Hybrid System GNSS/LORAN-C/Eurofix

Availability, Continuity, Integrity

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The Problem

Typical Test Course in an Urban Area

Visibility of EGNOS

true path with visibility of EGNOS Signals
true path without visibility of EGNOS Signals

GPS/GLONASS Measurements
(GG24 Receiver of MAN Technologie)

The GPS/GLONASS measurements show an offset and strong variance due to shadowing & multipath effects

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The Problem

Summary

• The figures show typical scenarios in for land mobile applications

• Strong influence of environmental conditions for satellite signals

• Visibility of EGNOS: 52 % (Estimated by Simulations)

• Mitigation of GPS/GLONASS reception: Large variance & Offset for Positioning Data

➢ Position determination by satellites cannot fulfil all requirements regarding Navigation System Performance Parameters:

   Accuracy, Availability, Continuity, Integrity

➢ However: No significant limitation of LORAN-C reception was detected

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The Concept

Need for navigation systems with high reliability and accuracy:

- Infrastructure for the safety of navigation is critical
- Drawbacks of a satellite navigation system conditional on system properties
- Traffic management systems cannot not be based on GNSS position determination alone

Solution:

- Hybrid receiver technology with combination of GNSS, LORAN-C and EUROFIX
- Enhancement of the system performance by calibration of LORAN-C signals using GNSS

- LORAN-C can be used as a complement for satellite navigation systems
  - Eurofix usable as wide area differential service
  - Most of LORAN-C infrastructure is existent
  - Cheap and reliable complement to satellite navigation systems

- Enhancement of the reliability for a combined GNSS/LORAN-C system
- Applicable for road & rail applications

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The Concept
GNSS/LORAN-C/Eurofix Hybridisation

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The Objectives

- **Test** the range of applicability and system performance in road and rail application

- **Development** and optimisation of receivers combining GNSS with Loran-C: Prototype manufacturing

- **Market opportunities**: Identification of
  - Areas of applicability
  - Assessment the corresponding potential
  - Development of appropriate implementation strategies

- **Market segments**: Identification of
  - the follower applications
  - the potential mass market
  - early market introduction,

- **GALILEO**: Investigations related to possible improvements of the GALILEO system implementation
The Workshare

Measurement campaign

User Requirements & Exploitation

Hardware & Software

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The Benefit for the User

Vehicle navigation or route guidance
Operating without integrating expensive dead reckoning systems, reliable map matching based only on the combined GNSS/ Loran-C position information.

Fleet management
reliable position determination covering even street section level in cities automated central map matching supported by the enhanced position data.

Precise traveller information in public transport increasing the acceptance of intermodal travelling, using the advantages of each transport mode.

Public transport operation management
safety relevant features (e.g. increase the train densities) high reliability of the position determination required.

Intermodal goods monitoring
Seamless tracking of containers throughout the different transport modes, including reloading terminals. Combined receiver systems provide the complete position information needed without additional sensors.

Road pricing
GNSS based technology is a promising option (not relied on roadside infrastructure) better availability and improved protection against degradation by a GNSS/Loran-C combination
Need for navigation systems with high reliability and accuracy

LORAN-C can be used as a complement to satellite navigation systems
- Most of LORAN-C infrastructure is existent
- Cheap and reliable complement to satellite navigation systems
- Eurofix usable as wide area differential service

GLORIA will contribute to
- Open new market segments for hybrid navigation systems
- Usage of the combined system for road & rail applications
- Design and prototyping of a generic GNSS - LORAN-C/EUROFIX receiver
- Possible improvements of the GALILEO system
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