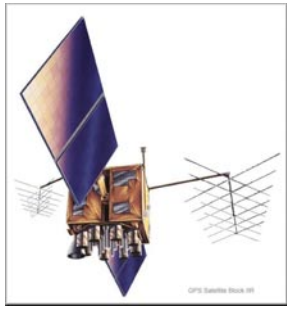
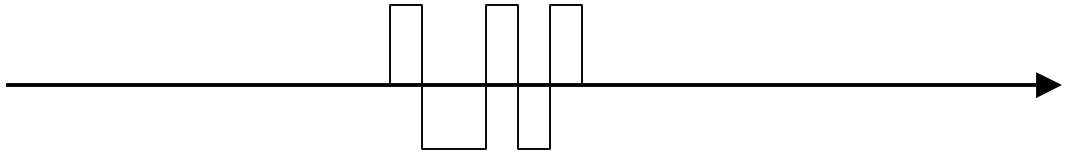
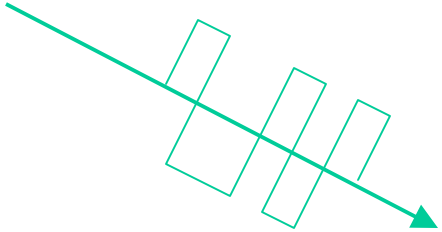
The Goal

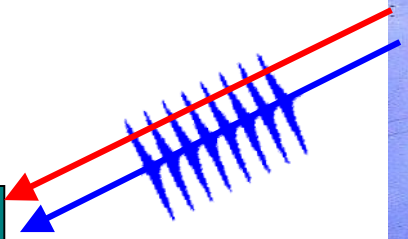
Hybrid System GNSS/LORAN-C/Eurofix

GLORIA









Improvements

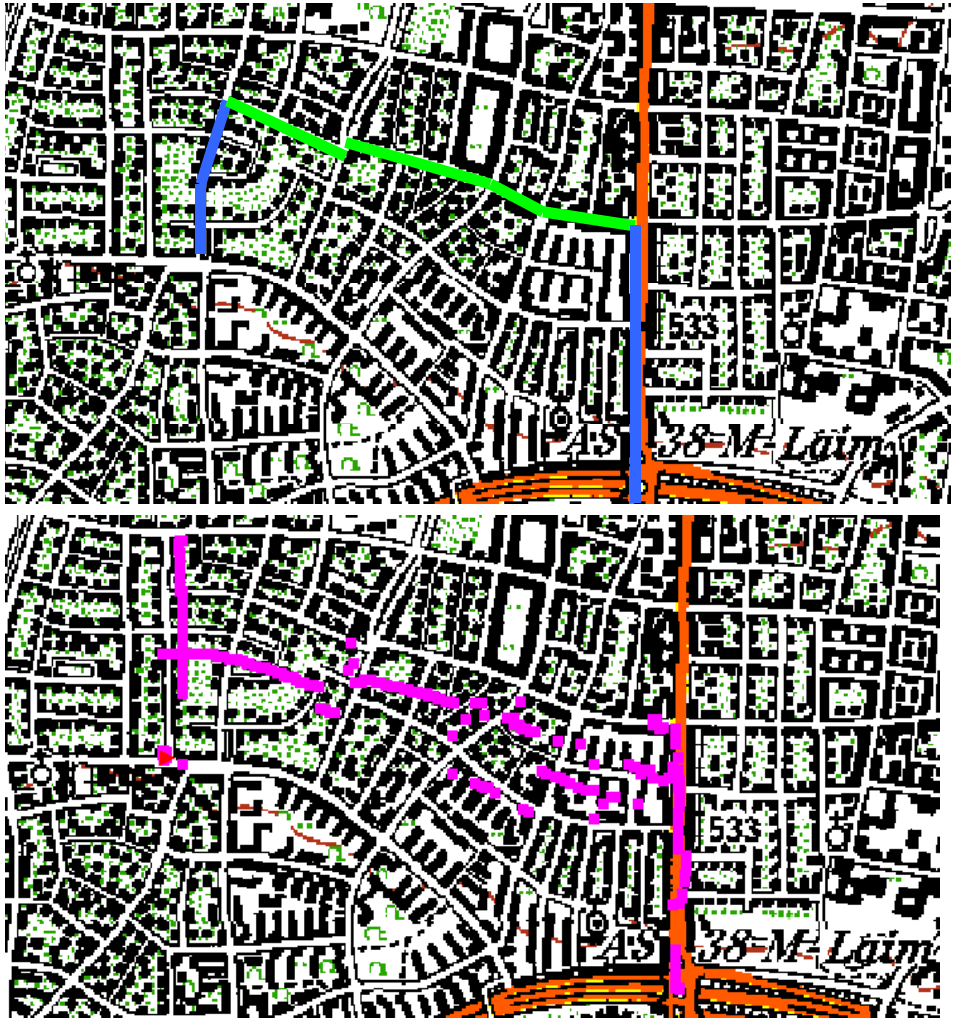
Availability,
Continuity,
Integrity

Applications

The Problem

Typical Test Course in an Urban Area

GLORIA



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

The Problem

Summary

GLORIA

- 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

The Concept

GLORIA

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

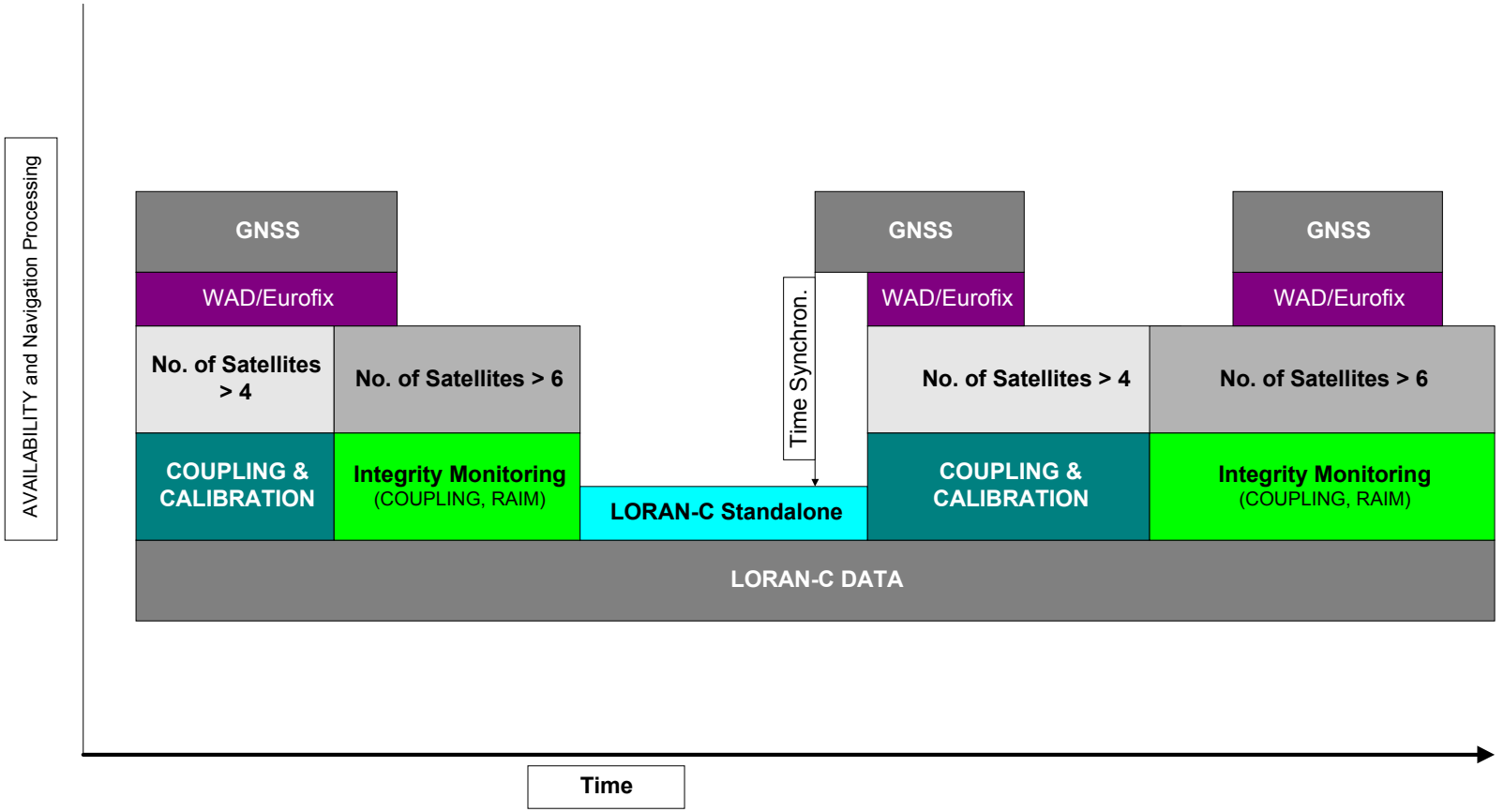
• Enhancement of the reliability for a combined GNSS/LORAN-C system

• Applicable for road & rail applications

The Concept

GNSS/LORAN-C/Eurofix Hybridisation

GLORIA



The Ojectives

GLORIA

- **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

GLORIA

Measurement campaign

User Requirements & Exploitation

ZIV
Zentrum
für integrierte
Verkehrssysteme

DE-Consult

Co-ordination
MAN TECHNOLOGIE

HiTec Marketing

TeleConsult AUSTRIA

ASIT

reelektronika b.v.

MAN TECHNOLOGIE

Hardware & Software

The Benefit for the User

GLORIA

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

Conclusion

- 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

Martin Maurer

GLORIA