How Does and Will GNSS (Galileo) Aid More Efficient Freight?
User Requirements of Urban Logistics for Guaranteed Galileo Value Added Services

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Fraunhofer IFF Testbeds for GNSS and Indoor Navigation/Localization

Transportation and Logistics

Intermodal Node

Last Mile

Indoor

City

Overland Traffic

Individuals and Staff

Athletes
Bördelandhalle MD

Seniors
Senior citizens’ home

Carts and Staff
Frankfurt Terminal
Outline

- Intelligent logistics today and tomorrow
- Best4City
- Galileo
- Case study
- Conclusion
### Intelligent Logistics for Small Volume Goods: Present → 2025

<table>
<thead>
<tr>
<th>Present</th>
<th>2025</th>
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<tbody>
<tr>
<td>Theft of goods is increasing over theft of utility vehicles</td>
<td>Value of the transported goods, e.g. W -&gt; O, or at airports is steadily increasing</td>
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<td>Near-cash goods are targets</td>
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<td>Valuable goods in special transport vehicles</td>
<td>High value goods are concealed in regular transports</td>
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<td>Telematic system are commonly used both for local and for long-distance transports</td>
<td>Tracking technologies for smaller parts of complete freight are omnipresent.</td>
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<td>City logistics is not yet established</td>
<td>Modular systems enable more flexible loading of a vehicle</td>
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<td>Road transport does not have standardized containers for smaller freight units</td>
<td>Smaller containers for smaller shipments - standardized variants for intermodal traffic</td>
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<tr>
<td>Specialized solutions apply value added services (Care - Cool - Fresh - Safe - Secure - Live)</td>
<td>Value added services are subject to permanent monitoring</td>
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<tr>
<td>Routing is based on static maps and traffic information</td>
<td>Routing is based on individual information for the driver</td>
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Cf. “ifmo – Zukunft der Mobilität”
# Ongoing Monitoring of Logistics Processes

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<tr>
<th>IT</th>
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<th>Quantity Check</th>
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<th>Storage Unit Generation</th>
<th>Documentation</th>
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**Discrete IT Support in Incoming Goods Processes - Present**

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**Permanent IT Support in Incoming Goods Processes - Future**
Best4City: Galileo Supported Low Volume Commercial Transportation

Based on an interchangeable trailer for small trucks (3.5 t)

Sponsored by the Federal Ministry of Transport, Building and Urban Affairs and by the Saxony-Anhalt Ministry of Regional Development and Transportation (No. 70.791/2006)
Best4City: Galileo Supported Low Volume Commercial Transportation
Research Project 2007/2008

Solutions for low volume inner city transportation
2.5 – 3.5 t
Best4City Concept

4 interchangeable trailers per truck

height: 2.40m
width: 1.70 m
length: 2.60 m
Area of Conflict: Commercial Transportation in Cities

Third-party Logistics
---
Retail Chain
---
CEP (Courier, Express, Parcels)
---
Local Carrier

Industrial Area → Commercial Area → Mall → City

Super Store > 1000 m²
Supermarket > 400 m²
Department Store > 3000 m²
Specialty Shop
Creative Business
Small Trade
Locked trailer
Entry in building
Hybrid power train 3.5 t Van
Condition monitoring

Long Distance Transport → Regional Transport → City Transport
semi-trailer combination → drawbar combination → interchangeable trailer → 3.5 t van
Best4City: Results of Talks with Local Government and Businesses

→ Roundtable talks with local government and businesses identified future needs and wants on the part of participants.

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<th>Carrier / Retailer</th>
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<td><strong>Stimulate</strong> business in cities</td>
<td><strong>Isolate</strong> processes</td>
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<tr>
<td>Focus: creative business</td>
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<tr>
<td>Increase cities’ attractiveness by reducing impacts of commercial transport</td>
<td><strong>Relocate</strong> transfer of goods</td>
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<td>(noise, dust, etc.) City toll, green zone, nighttime noise exposure</td>
<td>More flexibility when shipping and receiving convenience</td>
</tr>
<tr>
<td>Improve accident statistics by reducing large-volume inner city commercial</td>
<td><strong>Develop alternative, temporarily limited</strong> warehousing</td>
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<tr>
<td>transport (heavy vehicles)</td>
<td><strong>options</strong></td>
</tr>
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<td>Increase safety and security in logistics processes</td>
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<td><strong>Increase flexibility</strong> of transfer of goods</td>
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Interchangeable Trailer Scenarios

- Low cost
  - Outdoor tracking only (GSM, (A)GNSS)
  - Main goal: Common use for a variety of transportation tasks
- High-end
  - Outdoor tracking
  - Indoor tracking (UWB, WLAN, RFID, etc.)
  - Main goal: Intelligent freight tracking up through assembly lines
- Safety-critical transports
  - Additional sensors to monitor orientation
  - Rule-based applications
  - Main goal: Complete (uninterrupted) real-time monitoring of location and status of freight
Safety-critical Transports: Monitoring and Documentation

- Valuable Goods
  - Money transports
  - Mobile ATM
- Sensitive Goods
  - Fresh
  - Temperature-sensitive
  - Breakable
- Documentation and Certification
  - Event logging
  - Trajectory logging

Hazard Analysis and Critical Control Point (HACCP)
A protective system for edibles and consumers
- Observation of edible’s critical points - method of continuous supervision - action taking - documentation

Customs Security Program (CSP)
Introduces proper security controls to safeguard the domestic market and, in close cooperation with major trading partners throughout the world, secure international supply chains.
- Authorized Economic Operator (AEO)
Fraunhofer IFF Intelligent Box Components

Simple Antennas

Small Multiplexer

Off-road Navigation

Behavior Monitoring

RF Test Truck

Fraunhofer IFF at the DHL Innovation Center
Simulation Study Using a 3-D Model of the City of Magdeburg

- Simulated shadowing with a 3-D model
- Simulation of a delivery to a shopping mall
- Availability of GPS and Galileo Satellites along the trajectory
Best4City: Simulation of Trajectory Positioning

Quelle: Google Earth
Best4City: Horizontal Accuracy GPS Alone

Position accuracy GPS only

Start time: 2007-08-01 25:00:00
Best4City: Horizontal Accuracy GPS + Galileo

Position accuracy GPS+Galileo

Start time 2007-08-01 15:00:00
Mean Horizontal Accuracy (95%)

Legend:
- **GPS**
- **GPS and Galileo**
- **!!! No GPS position available**
- **○ +/- 10m**
Conclusion

- Intelligent city logistics concepts are needed
- Interchangeable trailers can support flexible logistics under various aspects
- The need for guaranteed tracking and documentation for all kind of freights is getting more important
- Galileo will improve the possibilities for more precise and reliable tracking especially in urban environments
- Value Added Services can be continuously controlled, even in real-time
The true story of the **Meissner Fummel**: In the days when mail was still transported by mail coach, mail from Meissen often arrived in Dresden damaged. It was rumored that the coachman was far too fond of Meissen wine. The Elector of Saxony ordered Meissen’s bakers to invent a pastry that was so fragile it would fall apart at the slightest vibration. Should the post coachman deliver this pastry to Dresden in one piece, he would be absolved of all suspicion.

**Past**

![Pastry](image1)

**Present**

![Pastry delivery vehicle](image2)

**Future**

![Future delivery system](image3)

**Target**: Continuously monitored value added services