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INNOVATIVE AND COST EFFECTIVE SPATIAL POSITIONING

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FIG Commission 5 „Positioning and Mesurement“

FIG Working Week 2013

Abuja, Nigeria, 06 - 10 May, 2013

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Structure

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- **Summary**

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Introduction

- Positional infrastructure is a key technology for the economy of any country: Reference Frames, Continuous Operating Reference Stations (CORS) , etc.
- Positioning is in general realized by surveyors / geodesists
- Instruments are highly accurate and therefore often expensive; this is valid for new instruments for spatial data acquisition too (e.g. Terrestrial Laser Scanning)
- Alternative: Low-Cost Instruments

Measure as accurate as needed not as accurate as possible.

Cost-Effective Positioning is the aim!.

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Surveying Instruments

Low Accuracy Level
Total Station: ca. 8 000 €
Level Instrument: ca. 2 000 €
GNSS Receiver: ca. 8 000 €

High Accuracy Level
Total Station: ca. 30 000 €
Level Instrument: ca. 10 000 €
GNSS Receiver: ca. 20 000 €

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New Development: Spatial Data Aquisition

- Terrestrial Laser Scanning (TLS)
- Ground Based Radar
- Terrestrial Photogrammetry

Investment Costs TLS
30 000 € to 100 000 €

Exemplary Laserscanners: Faro Focus 3D, Riegl VZ 100, Zöller & Fröhlich

Kinematic Spatial Data Acquisition / Mobile Mapping
Multi-Sensor-Systems; mainly by specialized companies.
Investment costs: even higher!

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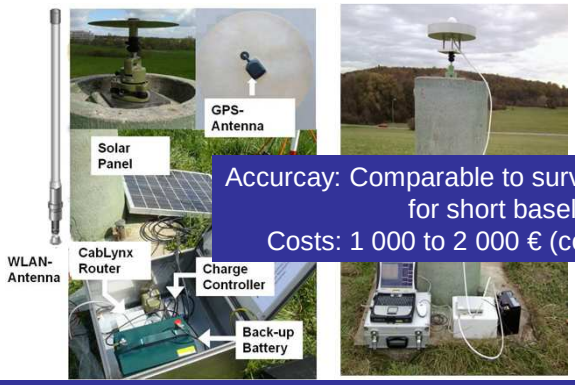
Low-Cost Instruments

- GNSS receivers (mass market receivers): **yes**
- Level instruments and total stations: **no**



Accurcay: Comparable to survey grade reveivers for short baselines
Costs: 1 000 to 2 000 € (complete system)

Alternative:
Positioning by mobile / smart phones (GNSS or mobile phone positioning)
Accuracy: some m to some km
Costs: 0 to 700 € (complete system)

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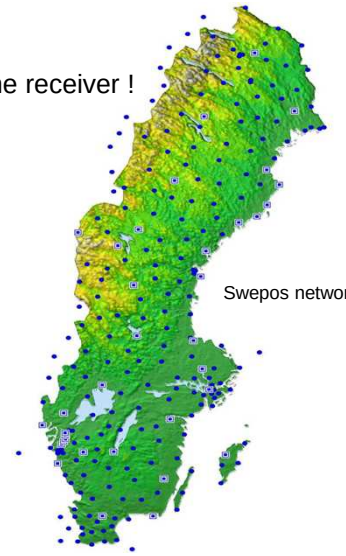
Positional Infrastructure

GNSS CORS networks improve
accuracy and reliability and econimize one receiver !

CORS station within Swepos network



Swepos network

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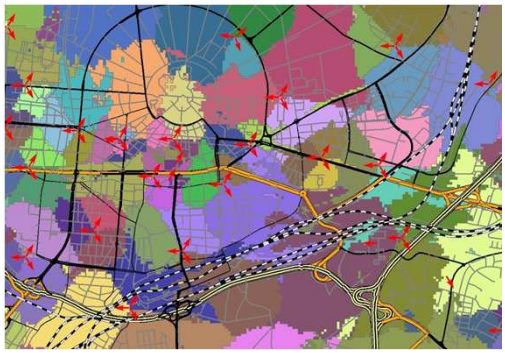
Positional Infrastructure

Mobile phone networks are important
- for data real time transfer of GNSS networks
- to support of GNSS positioning (A-GNSS)
- for positioning by mobile phones



Mobile phone network in Karlsruhe, Germany

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Cost-Effective Positioning

Simple decision table
for the case that personnel and any other cost have no influence or are the same for all instruments compared.
Only investment costs and accuracy (quality) are counting!

Instrument	Max. Accuracy	Investment	Invest per year
Type A	1 cm	8 000 €	1 600 €
Type B	0.5 cm	15 000 €	3 000 €
Type C	1 mm	25 000 €	5 000 €

Measure as accurate as needed not as accurate as possible.

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Cost-Effective Positioning

Complex decision table
Influences: personnel, investment and additional costs.
Important: personnel costs per hour / day / year.

Instrument	Max. Accuracy	Invest per year	Personnel per year / (1 €)	Personnel per year / (70 €)	Fees / Communication per year	Overall costs (1 €)	Overall costs (70 €)
Total Station	1 mm	5 000 €	4 000 €	270 000 €	-	9 000 €	275 000 €
Robotic Total Station	1 mm	6 000 €	2 000 €	135 000 €	-	8 000 €	141 000 €
Low-Cost GNSS / CORS	5 mm	500 €	2 000 €	135 000 €	1 000 €	3 500 €	138 000 €

Developed Countries:
Automation and positional infrastructure important .
Developing Countries:
Low-Cost instruments and positional infrastructure important.

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Cost-Effective Positioning

Decision table for huge data amounts
Example: 500 m street & facades

Investment (5 years)
Robotic Total Station: 30 000 €
TLS: 100 000 €

Method	Max. Accuracy	Invest	Personnel (1 €): field / office	Personnel (70 €): field / office 8 days / 1 day	Assign-ment costs	Overall costs (1 €)	Overall costs (70 €)
Robotic Total Station	1 mm	1 000 €	64 € / 8 € **8 days / 1 day**	4480 € / 560 € **8 days / 1 day**	-	1 072 €	6 040 €
TLS	2 mm	830 €	16 € / 40 € **2 days / 5 days**	1120 € / 2 800 € **2 days / 5 days**	-	886 €	4 750 €
Mobile Mapping	2 mm	-	-	-	10 000 €		10 000 €

TLS cost-effective although investment costs higher.

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Summary

- Presentation of well-known geodetic techniques and low-cost alternatives as well as new developments for spatial data acquisition
- Importance of positional infrastructure is highlighted
- **Cost-Effectiveness** means
  - using the quality level required,
  - using the automation level required,
- - using positional infrastructure,
  - taking into account all costs,
  and decide for the survey instrument and procedure delivering the required quality
  with minimal financial effort !


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Thank you very much for your attention!
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