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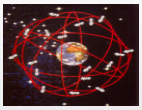

21 March 2013 – Budapest

Day of the European Surveyor and Geoinformation

"GNSS - the benefit of satellite geodesy – 10 years experiences in NRW, Germany"

Dr. Jens Riecken, DVW-Vice President
GEOBASIS.NRW, Cologne District Government, Germany

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Agenda

GNSS-Reference stations / Official geodetic reference

Costs and benefit
- **geodetic reference**
- **cadastral surveys**
- **cadastre**

GNNS 2020 – what could we expect

Navigation in the past, today and tomorrow

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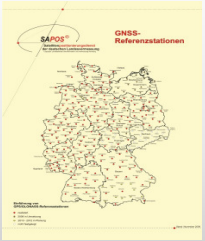
260 GNSS-Reference stations of the German Surveying and Mapping agencies ...



Services:	HEPS	EPS	GPPS
	real time	real time	post processing
Accuracy:	0,01-0,02m	0,3-1m	<0,01m
Acc elev.:	0,02-0,03m	1-5m	0,01-0,02m
Use:	cadastre	topogr.	special surveying

Characteristics:

→ **Provides the *official geodetic reference***

→ **Accepted measurement tool of the private marked (licensed surveyors)**

Official Geodetic Reference (in Germany)

Integrated approach of geometric and physical defined components:
- 3D-position / Ellipsoid / position / ellipsoid height (geometry)
- and Dynamic height / potential.

New concept:
Integrated Geodetic Reference:
Combination of physical heights, 3D-coordinates and potential
→ geodetic fundamental points

Physical point representation
→ Geodetic fundamental point, multi functional

„Virtuell" representation via precise defined height („Millimeter-Geoid/ - Quasi geoid").

No time component, no movement.

GNSS - costs (2007-2012) - NRW

27 reference stations in North-Rhine Westphalia, Germany

Costs: → software, services, warranty, hardware, telecommunication
(2007-2012)
(6 years = life time equipment)

→ x.000 EUR/Ref.Station/year

+ Personal costs (NRW): ~ x00.000 EUR / year
→ SAPOS-NRW: ~ x70.000 EUR / year

[Estimation for SAPOS Germany (260RS) ~ x.000.000 EUR / year] ?
[Estimation for EUROPE (1000RS) ~ xx.000.000 EUR / year] ???

GNSS - benefit for geodetic reference - NRW

1975 (before GNSS)
Personal in Geodetic Reference
115

2013 (SAPOS: RTK – GNSS)
Personal in Geodetic Reference
(incl. GNSS) 40

GNSS - benefit for geodetic reference - NRW

1975 (before GNSS)	2013 (SAPOS: RTK – GNSS)
Personal in Geodetic Reference	Personal in Geodetic Reference
115	(incl. SAPOS/GNSS) 40

Difference: -75 (i.g. less qualified)

Benefit (only for NRW-geodetic reference): **~ xxxx EUR/year**

[Benefit Estimation for SAPOS Germany ~ xx.000.000 EUR / year] ?
[Benefit Estimation for EUROPE ~ xx.000.000 EUR / year] ???

GNSS - benefit for cadastral surveys
(only private sector / licensed surveyors)

before GNSS **2013 (SAPOS: RTK – GNSS)**

GNSS - benefit for cadastral surveys
(only private sector / licensed surveyors)

before GNSS	2013 (SAPOS: RTK – GNSS)
Survey troop: 3-4	2 Δ = -1
Survey time:	Δ = -30%
Survey equipment:	
theodolite, prism	GNSS, total station, GIS

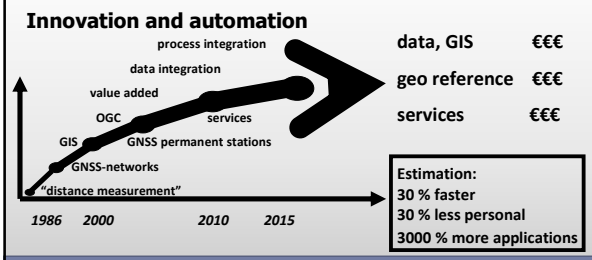
Benefit estimation for one survey troop : x EUR / year

Germany: 1.200 offices, 2.400 survey troops

(private sector) → ~ x.000.000 EUR / year ?

Conclusion: GNSS is one of several steps of automation in the surveying profession

GNSS and GIS - benefit in the cadastre



data, GIS	€€€
geo reference	€€€
services	€€€

Estimation:
30 % faster
30 % less personal
3000 % more applications

GNNS 2020 – what could we expect

Satellites	Today	2020
GPS	31	32
GLONASS	24	24
BeiDou	14	35
Galileo	2	30

GNNS 2020 – what could we expect

more satellites: better access
Accurate code-measurements: m →dm
Accurate satellite positions, -clock correction: m → 0,5 m
Measurements on two or three frequencies:
→ ionosphere correction
→ improvements for code positioning
A new area for precise and cheap dm-navigation
Fast and reliable precise cm-surveying

GNNS 2020 – what could we expect

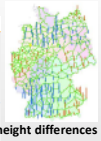
cm- satellite position, -clock correction, FCB
- provided by GNSS-satellites
- need for permanent communication to the satellites
→ PPP (fixed) with „some cm“ after some minutes

+ local information about ionosphere / troposphere
- terrestrial communication
- allows fast ambiguity resolution
→ (PPP-)RTK, fast with cm-accuracy

GNNS 2020 – what could we expect

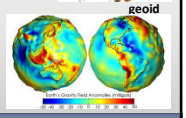
Global Change
- challenges for the surveying profession: “observe, describe and interpret processes in time and space” **(x, y, z, t)**

GNSS- and leveling network

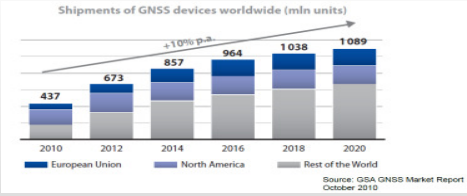


height differences

geoid

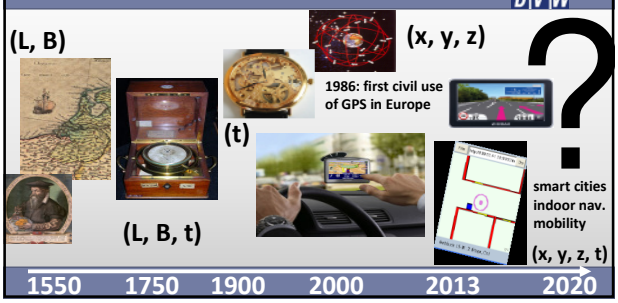


Navigation in the past, today and tomorrow



According to the GSA report, the market for GNSS will grow significantly over the next decade, at a compound annual growth rate of 11%, reaching some €165 billion for the core GNSS market in 2020. Delivery of GNSS devices will exceed one billion per year by 2020.

Navigation in the past, today and tomorrow



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questions ?

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