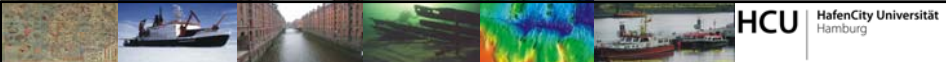


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Optimization of Hydrographic Positioning and Attitude Determination

Prof. Dr.-Ing. Volker Böder
HafenCity University
Department of Geomatics



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Hydrographic Education in Hamburg

- January 2006: Department of Geomatics moved to the **HafenCity University (HCU)** Hamburg
 - new founded by the Federal State of Hamburg
 - well-established departments (architecture, civil engineering, geomatics, urban planning) from different universities

only institution in Germany offering a two-years post-graduate program (M.Sc. Hydrography), which is accredited according to the “Standards of Competence of Hydrographic Surveyors” by the IAB of FIG/IHO/ICA at Category A

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HafenCity Hamburg (2010?)

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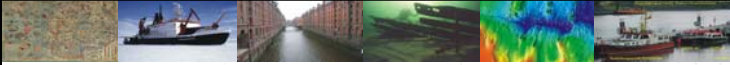
Equipment HCU

HafenCity University Hamburg / Department of Geomatics

Multipurpose Vessel POSEIDON
Research / Training / Survey Craft LEVEL-A

12-5-2005

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Goals

➤ **Precise Positioning**

- Based on GPS carrier phases with ambiguity determination
- Accuracy better than 3 cm
- Distances to reference station up to 40 km
- Real-time capability
- fast ambiguity resolution
- Advanced reliability and availability with INS integration

➤ **Attitude Determination**


- Based on GNSS and INS

embedded
in one
concept

independent
from
GNSS/INS
manufacturer

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Strategy

Reducing the GPS Error Budget

Distance Dependent
Station Dependent

Active Network
Calibration

Reference Station

Improvement of Availability

GNSS/INS-Integration

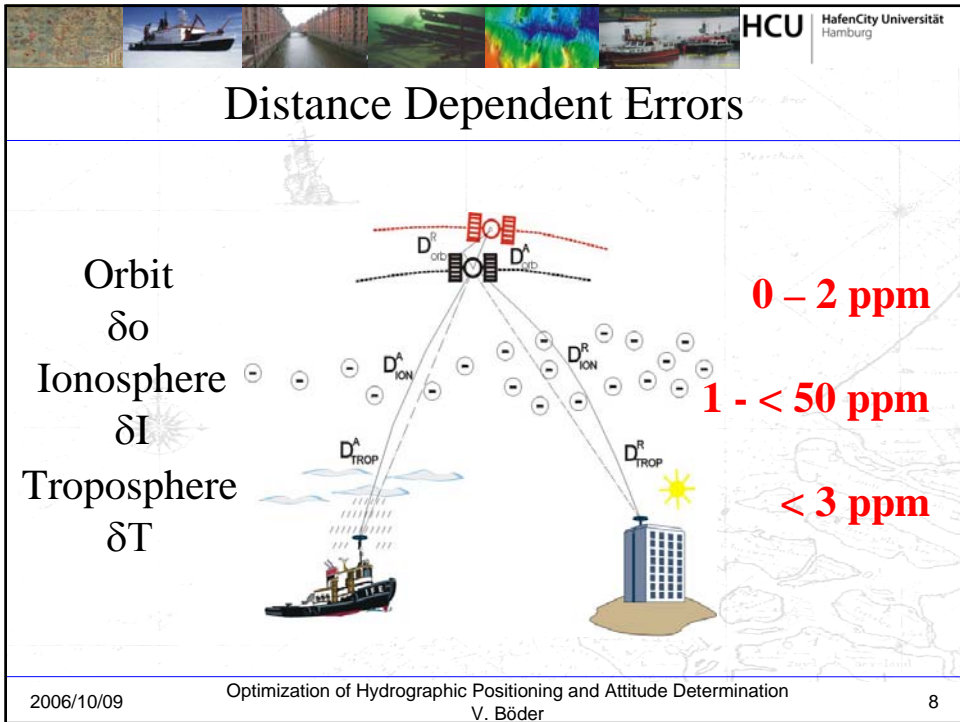
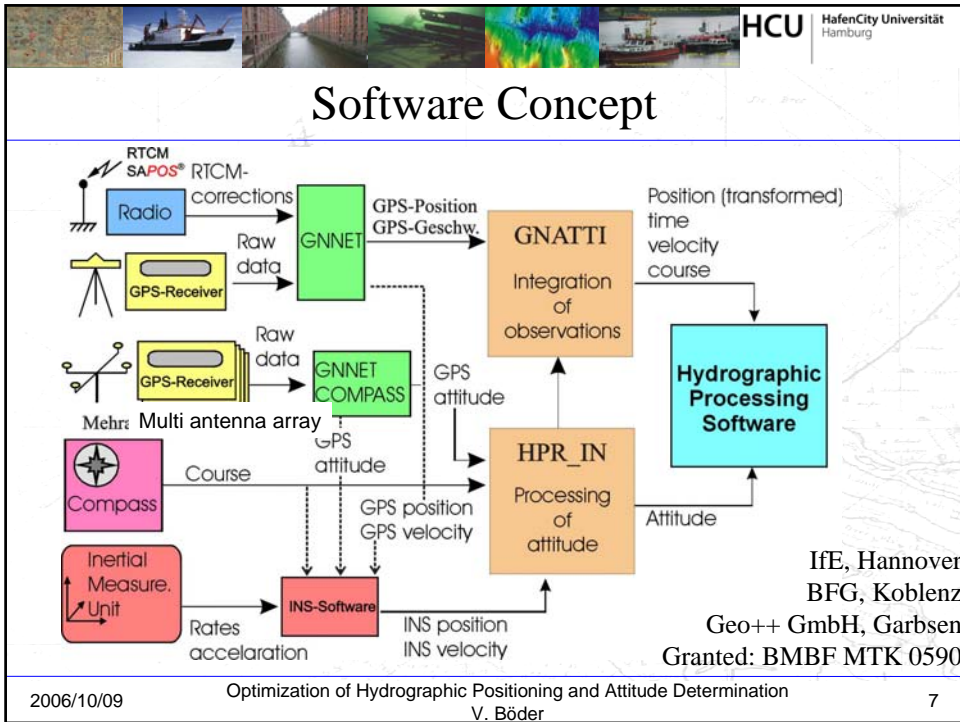
Transformation to Hydrographic Sensor

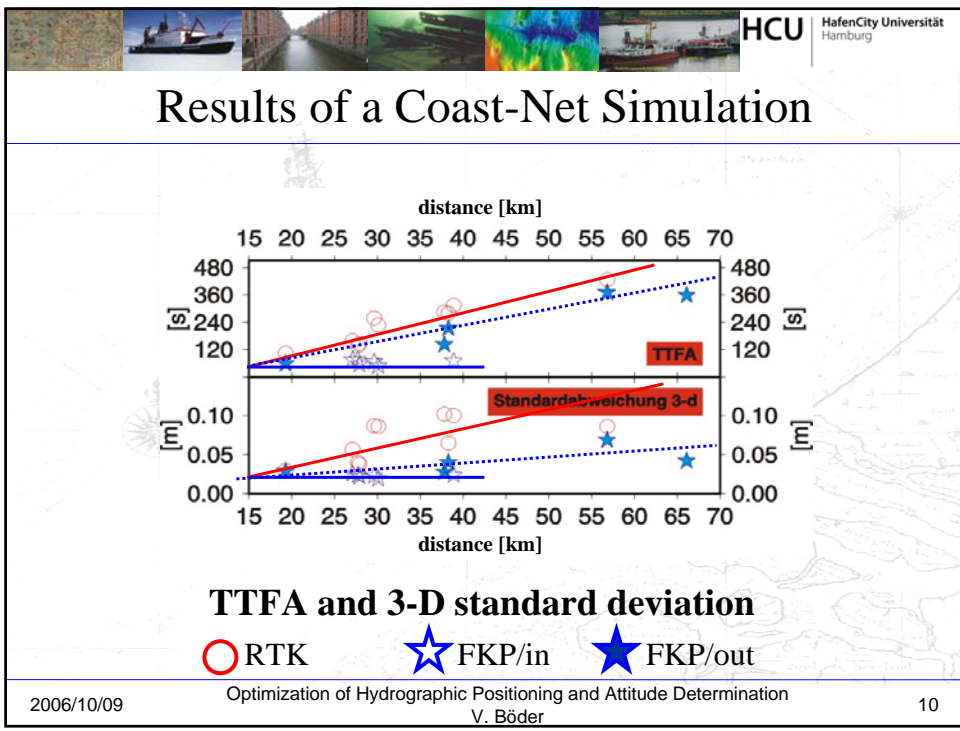
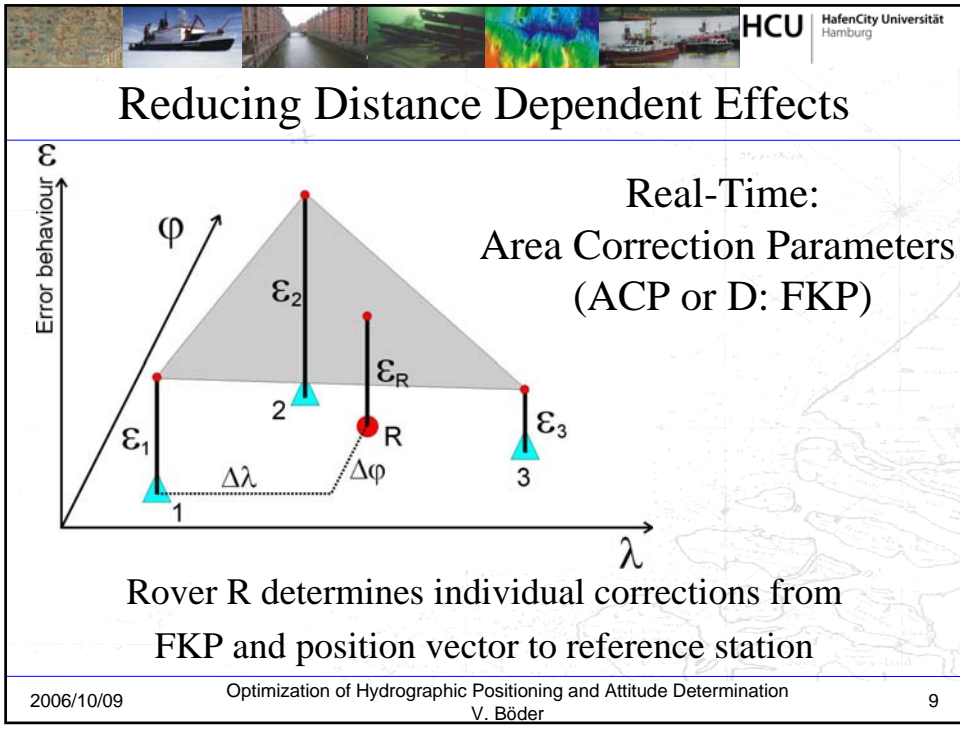
Attitude Determination (GPS, INS, GPS/INS)

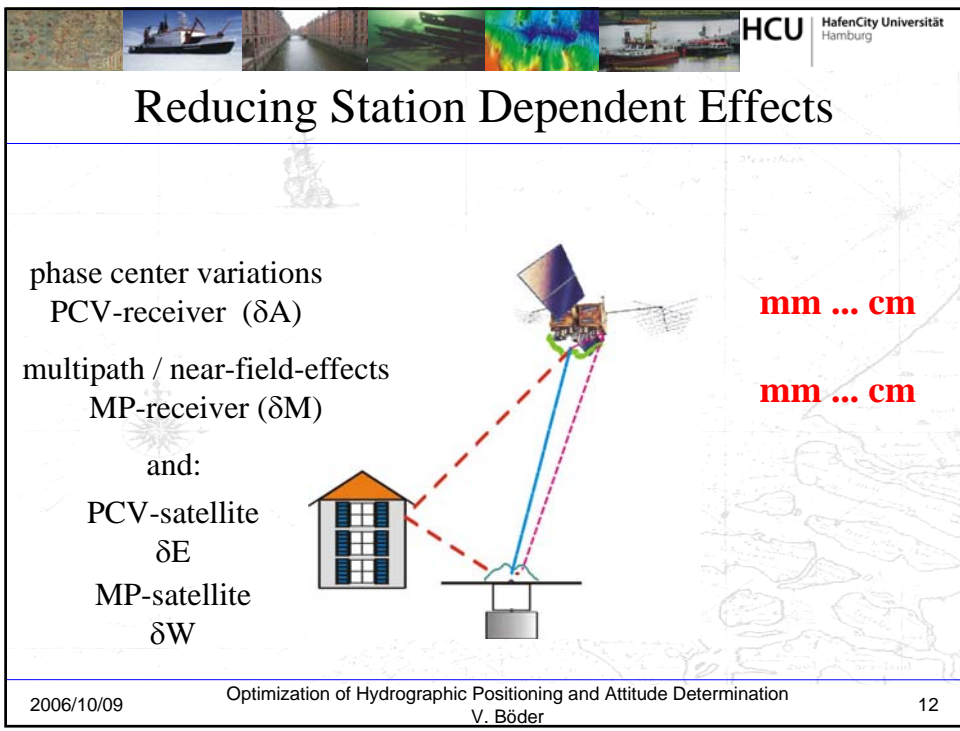
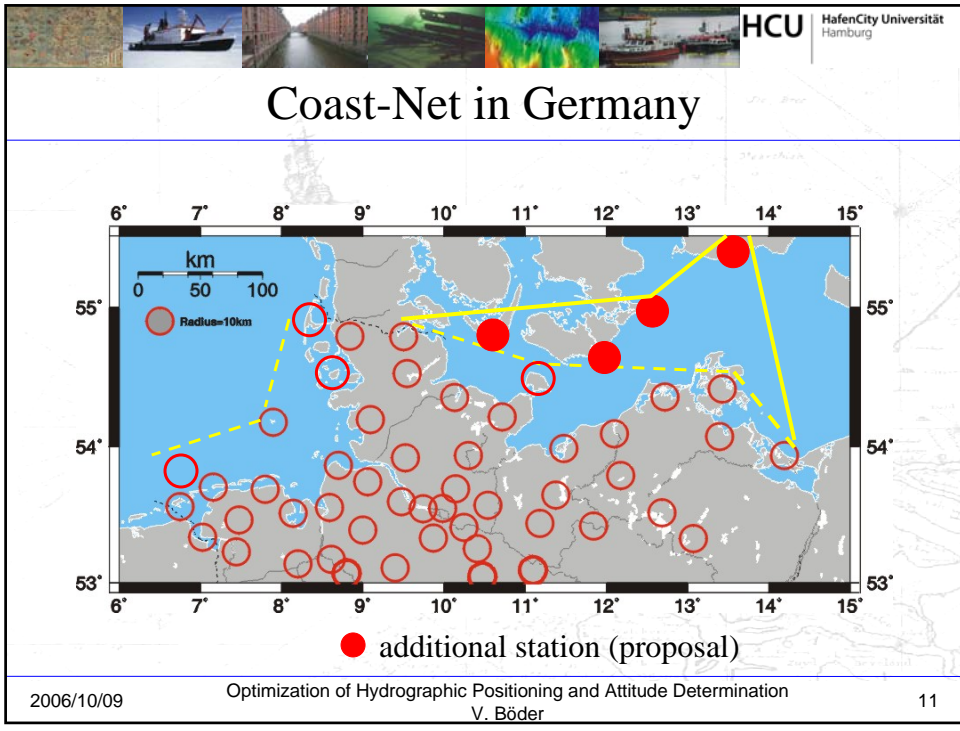
Rover

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MP/PCV Calibration for Kinematic Applications

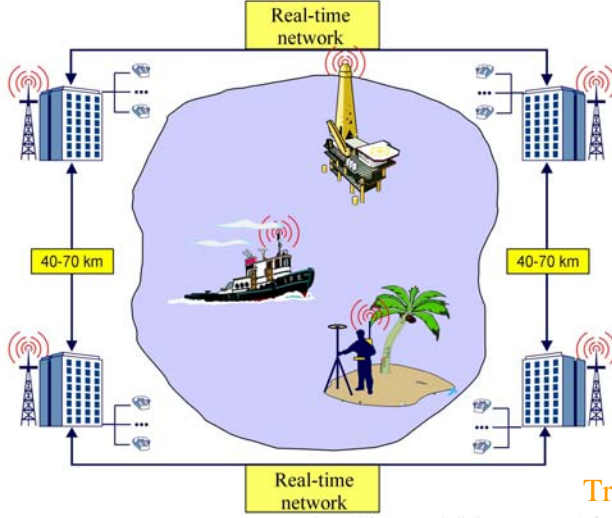



Helipod Calibration
February 2005
Geo++ GmbH, Dr. Schmitz

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Reducing GPS-Error Budget



antenna- and station-calibration (Hannov. Method)
 +
 reference station network
 =
 GPS-positioning cm-accuracy (maybe better?)

Loss of data?
 Transformation to Sensor?

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GNSS/INS-Positioning

➤ Experiments: bridging data gaps with **low cost** INS

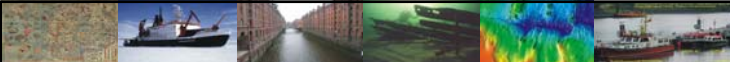
- possible functions for INS-positioning:
 - Support of ambiguity search (min. 5 cm/5 s)
 - Max. 1-2 seconds
 - Bridging data gaps (accuracy 3 cm)
 - Max. 1-2 seconds (for height determination)
 - Navigation solution (2 dm/3 s)
 - „extrapolate“ GPS-solution for real-time

-
+/-
+

⇒ Better results with sophisticated INS possible

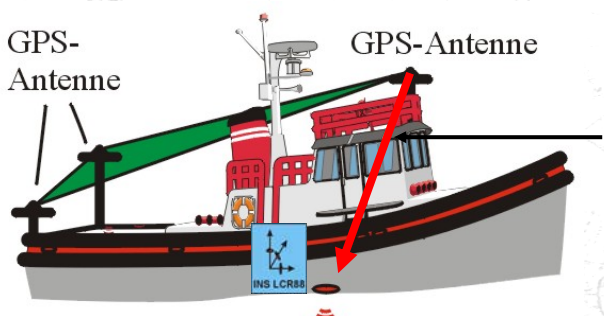
⇒ LCR-88 appropriate for attitude determination and navigation purposes

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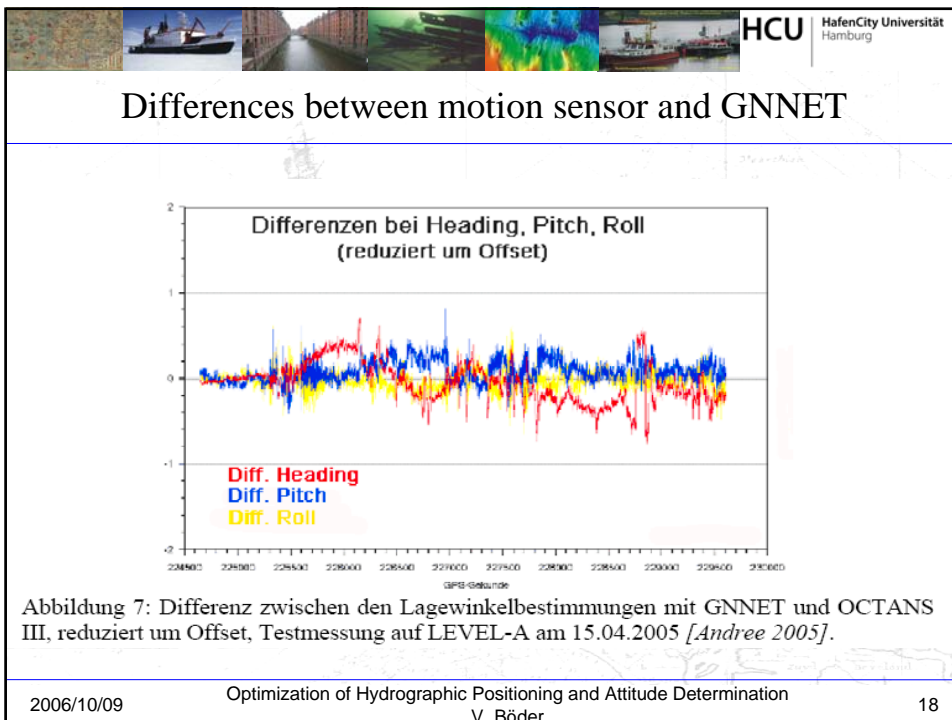
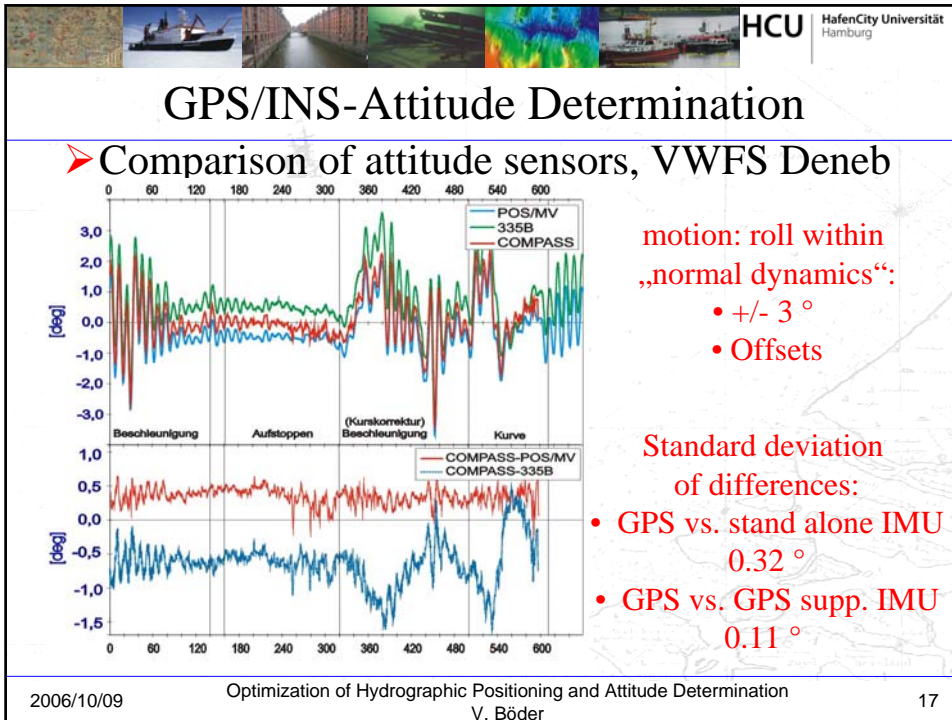
GNSS/INS-Attitude Determination

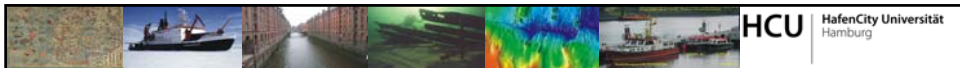


Rotation
with
course,
roll,
pitch

- GNNET/GNATTI: GPS multi antenna array (2 antennae)
 - Goal 1: using GPS heighting for depth measurements
 - Inertial sensors
 - transformation of GPS-Position to under
 - Goal 2: using GPS attitude for MBAS accuracy: 0.1°

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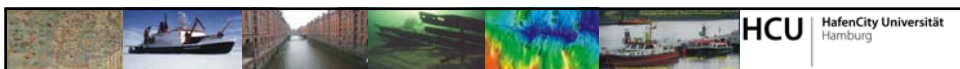
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Robot-test (Geo++, Garbsen)

Motion Sensor versus Roboter

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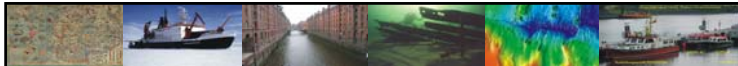


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Conclusions

Nearly all demands in question
 in the field of marine positioning
 within the range of a regional
 network of reference stations
 may be fulfilled
 with a complete optimized system
 based on the methods shown in this presentation.

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Prof. Dr.-Ing. V. Böder
HafenCity University Hamburg
Department of Geomatics
volker.boeder@hcu-hamburg.de

Welcome to HCU

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