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Mobile Laser Scanning on Board Hydrographic Survey Vessels

-Applications and Accuracy Investigations

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Introduction

- High resolution 3D mapping using modern mobile multi sensor systems below water in real time as standard (Kinematic 3D data acquisition)
- Difficult to scan waterside objects above water (river embankments, harbour)
- Studies for TLS integration into a hydrographic system

HCU - Mobile Hydrographic Multi Sensor System

RTK
SAPOS RTCM

Terrestrial laser scanner
Rieg VZ400

Motion sensor
IXSEA OCTANS III for TLS: HYDRINS/PHINS

Multi beam echo sounder
Reson SeaBat 8101
- 240 kHz
- 141 beams
- 1.5 beam width
- 210° swath width
Pilot study – Riegl VZ-400

- Project Grasbrookhafen Hamburg using the surveying ship “Deepenschriewer” from Hamburg Port Authority
  - 17.2m length, 4.9m width, and 1.4m draught
- Master Thesis of Thomas Thies as co-operating project between HCU and HPA (finished 2011)

Pilot study – Riegl VZ-400

- Setup
  - TLS – GNSS – IMU onboard of Deepenschriewer III
Pilot study – Riegl VZ-400

- Visual precision analysis at quay wall
  - 2 profiles East-West closely coincident
  - 1 profile West-East with deviation to EW: 7cm in XY & 4cm in Z

Sensor Integration of GNSS/IMU, echo sounder and terrestrial laser scanner
Pilot study – Riegl VZ-400 (Bar scene)

- Elimination of systematic effects after additional Roll & Pitch calibration in QPS Qinsy/Qloud

Pilot study – Riegl VZ-400

- Precision analysis – Surface Differences (Reference - Survey Line)

Surface Differences
Mean: -0.011m
StdDev: ±0.011m

- Computation only with plane facade surfaces without windows etc.
- Small height dependent systematic artefacts have to be investigated in more detail

Surface Differences
Max. +/- 2 cm
Project High-Rhine: Motivation

- Motivation of Orderer: Tiefbauamt Basel and Eidg. Bundesamt für Umwelt (CH)
  - Flood events in the last decades
  - International Rhine flood management (CH, F, D, NL)
  - City planning: Basel: increasing use of areas close to the banks for living
- Missing: precise 3-D model
- 4 test areas (around 17 km)
Precision after first post processing
2-3 cm
Not mentioned: difficult areas
Conclusions & Outlook

- Successful integration of two TLS (IMAGER 5006i & VZ-400) into mobile hydrographic multi sensor systems in three projects
- High precision 3D scanning & data processing in real-time
- Precision of kinematic 3D scanning depending on quality of IMU
- Performance advantages for Riegl VZ-400 due to technical specs
- Several problems with the combinations of different sensor coordinate systems: only phone calls/trial&error helps

Accuracy: 2-3 cm reachable

Conclusions & Outlook

- Possible applications:
  - 3D mapping for harbour applications (wharfage, bridges, etc.)
  - 3D corridor mapping of rivers and its biotopes, flood analysis
  - Topographic survey of coastal and river banks
  - Monitoring of dike security & drying-falling tideland areas
  - Determination of trim behaviour (squat & settlement) of ships

BLASTer?
Comm. 4 Working Group 3:

Multi-Sensor Systems for Hydrographic Applications
- Knowledge base for new technologies (not only LS)
- Report, analyze, document, (solve) problems of hydrographic MSSystems in general
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Thank you for your attention

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