Alberding DGNSS solutions for inland waterways

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Alberding GmbH

DISC' 12 Vukovar

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Outline

Alberding GmbH

Alberding GNSS Software

Projects

Beacon.net

Future developments

Alberding GmbH

- GNSS software development company
- Founded in 1994 in Leipzig, Germany
- Based in Berlin (Schönefeld)
- Independent from GNSS receiver manufacturers
- Started GNSS software development in 2003
- Developer and provider of integrated GNSS hardware
- 8 engineers + external employees

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Alberding GNSS Software

Projects

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Future developments

Alberding GNSS software

- Development of system solutions for GNSS infrastructure operators
  - GNSS data processing and analysis
  - Monitoring systems
  - Internet based data communication (Ntrip)
  - Customised software and hardware solutions
- Standardisation (RTCM SSR, MSM, Ntrip 2.0)
- Technology development (PPP, NAV4BLIND)
- Consulting
- Studies

Alberding GNSS infrastructure solutions

Complete DGNSS Solution

- based on a modular concept -

GNSS receiver

GNSS Measurements

other GNSS datasource

Reference Station

» Receiver control
» Pre-Processing
» Data Management
> Storage
> Format conversion (i.e. RTCA --> RTCM)
> Data steaming
» Local GNSS Data distribution (RTK, DGNSS)

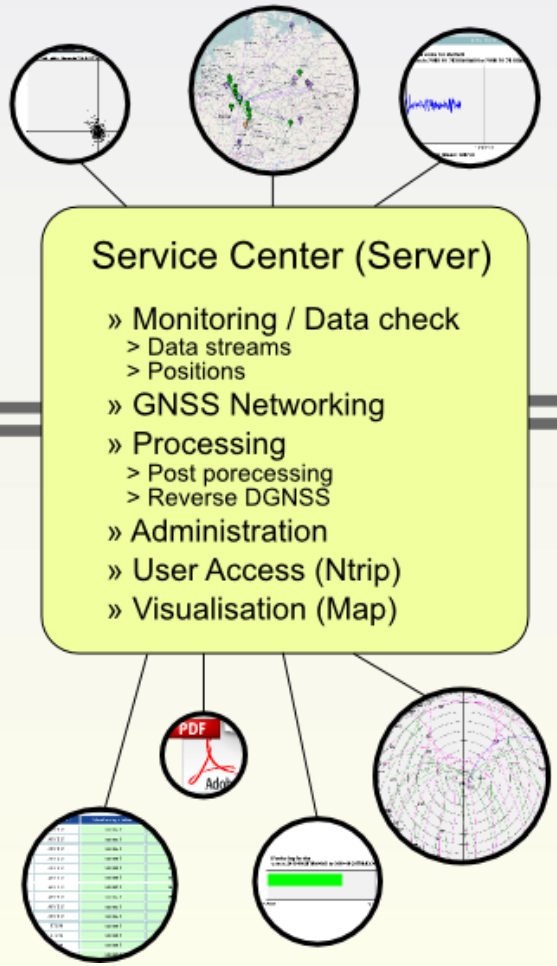
Service Center (Server)

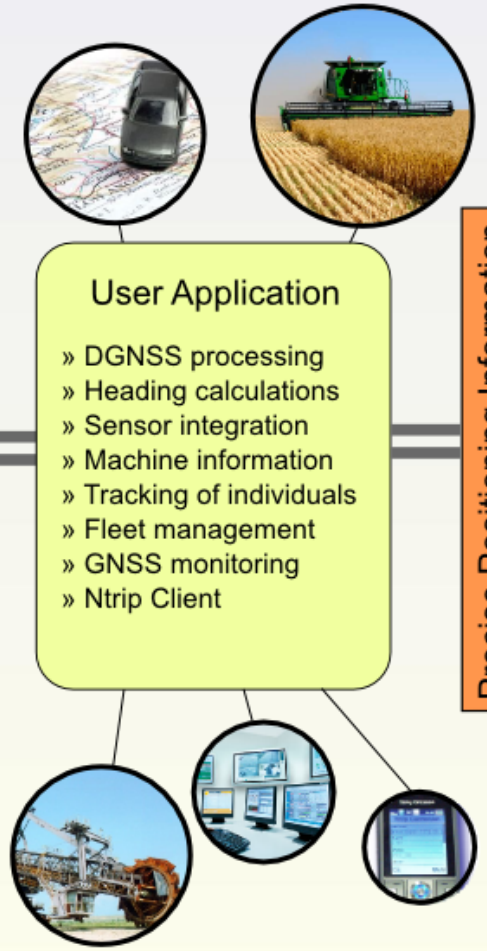
» Monitoring / Data check
> Data streams
> Positions
» GNSS Networking
» Processing
> Post porecessing
> Reverse DGNSS
» Administration
» User Access (Ntrip)
» Visualisation (Map)

User Application

» DGNSS processing
» Heading calculations
» Sensor integration
» Machine information
» Tracking of individuals
» Fleet management
» GNSS monitoring
» Ntrip Client

Precise Positioning Information





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Alberding GNSS Software

Projects

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Future developments

Alberding GNSS projects

- Landslide monitoring
- Positioning of excavators
- Wind turbine monitoring
- Toll Collect receiver evaluation
- PPP service development
- Navigation for the blind

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Alberding GNSS Software

Projects

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Future developments

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- Existing maritime and inland waterway DGPS services require modernisation
  - Aging Beacon DGPS hardware and software
  - Augmentation information for future GNSS signals
- VRS concept – a solution in line with the IMO e-Navigation strategy
  - Virtual Reference Station (VRS) solution – corrections and integrity information generated at a central site
  - Separating the GNSS correction generation from the data transmission technology (radio beacons, AIS, etc.)

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- Modular GNSS software designed for the operation of maritime and inland waterway DGNSS services
- Designed to run on Internet server systems with remote access

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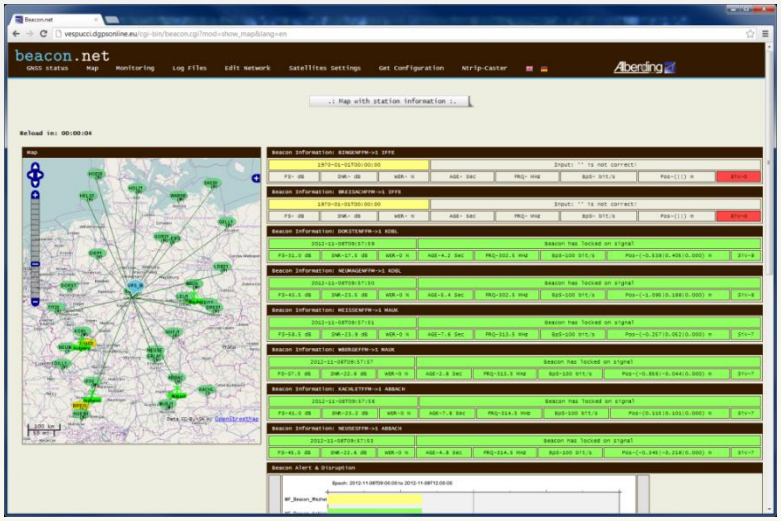
Modules of Beacon.net

- **VRS server**
  (Network DGNSS processing)
- **Data transmission**
  (IALA radio beacon, AIS, Ntrip)
- **Integrity monitoring**
  (PBM and FFM)
- **Beacon transmitter control**
  (under development)



VRS server module

GNSS input data

- Collecting GNSS observation data from multiple reference stations in real time
  - IALA beacon stations
  - AIS DGPS base stations
  - Other GNSS reference stations
  - Ntrip Casters

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VRS server module

GNSS reference station networks operated by SMAs

VRS server module

Input data filtering

- Converting GNSS data to a common data format for processing input
- Pre-processing of the observations
  - Filtering false GNSS measurements
  - Detecting antenna movements
  - Synchronising measurement records to a single epoch

VRS server module

Generation of DGNSS network corrections

- Calculation of corrections for the network centre point.
- Calculation of area corrections from the GNSS reference station network
- Generation of RTCM corrections for user definable locations within the network coverage area
- Virtual Reference Stations = no GNSS receiver at the sites needed
- Support of DGPS and DGLONASS

VRS server module

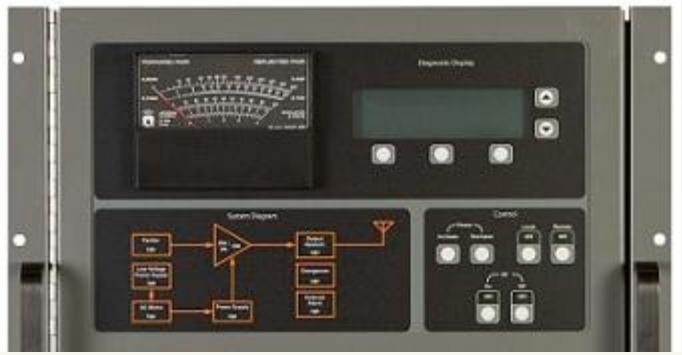
EGNOS data conversion

- SBAS RTCA data conversion to RTCM for definable positions („EGNOS VRS”)
  - Corrections generated for e.g., AIS base station locations
- Input data sources:
  - EGNOS enabled GNSS receiver
  - EDAS (EGNOS Data Access Service) via IP
- EGNOS is available free of charge
- EGNOS service is monitored by system operator
- EGNOS coverage extension to Eastern Europe to be declared soon
- Can be used as a backup solution

RTCM data transmission

Data dissemination via different channels

- Support of multiple RTCM message types for broadcasting via
  - Radio beacon stations (#1, 3, 9, 31, 34)
  - AIS (AIS message #17)
  - Mobile Internet (definable)
  - Other local or global data links

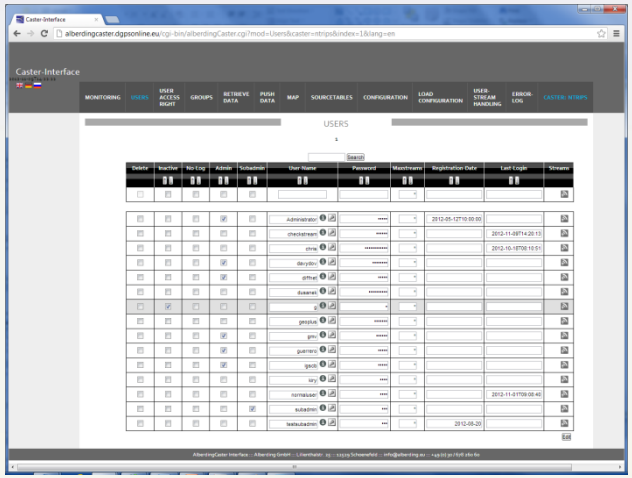


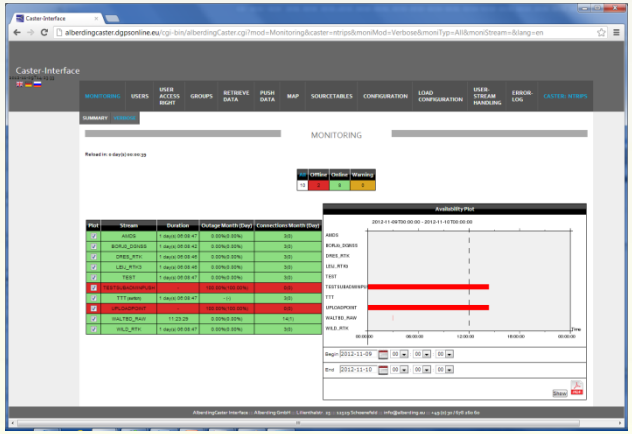
- Separation of the DGNSS service from the delivery channel
  - Different data formats and GNSS information via different data links (i.e. RTK via mobile Internet / WLAN)

RTCM data transmission

Alberding Ntrip Caster – RTCM via IP

- Data collection from different GNSS reference stations (Ntrip, TCP, UDP)
- Data distribution to users
  - Handles a large number of simultaneous connections
  - High reliability with low system requirements
  - Nearest base option
- Web interface
  - Ntrip stream and user account administration
  - User access and stream availability monitoring
  - Automatic alerts via email or SMS
  - Map display of user positions → fleet management
  - Different levels of access

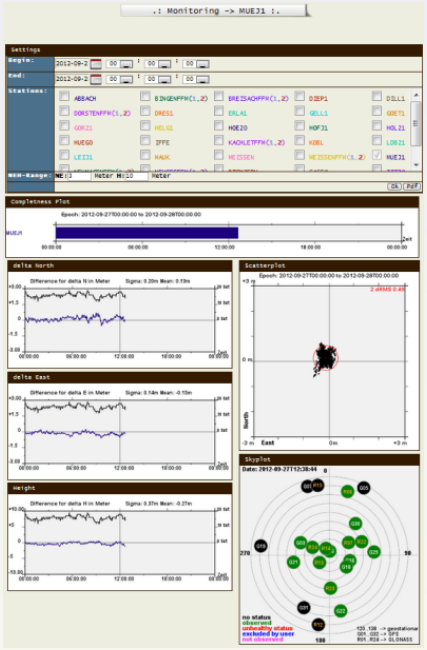


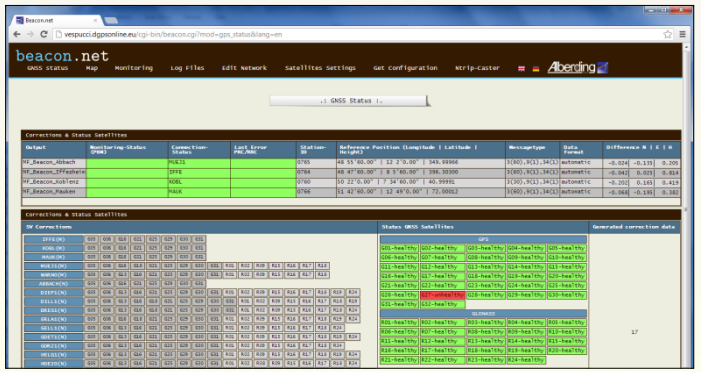


Monitoring module

Pre-broadcast monitoring (PBM)

- Integrity monitoring of the raw data streams and the DGNSS corrections before the data transmission (IALA standard)
- Reference station specific monitoring
  - Position accuracy against threshold
  - Monitoring status in RTCM Header
    - „ok”
    - „unhealthy”
    - „not monitored”
- Satellite specific monitoring (SV health status, PRC, RRC)
    - „ok”
    - „do not use” if PRC/RRC > threshold
    - „ ” (no corrections) if satellite is unhealthy

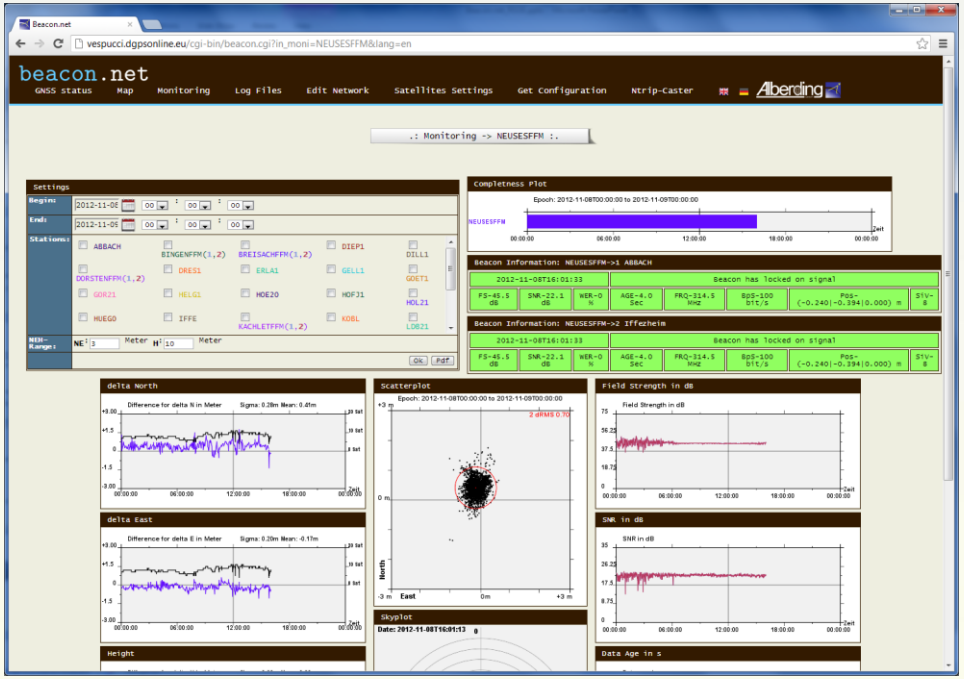




Monitoring module

Far field monitoring (FFM)

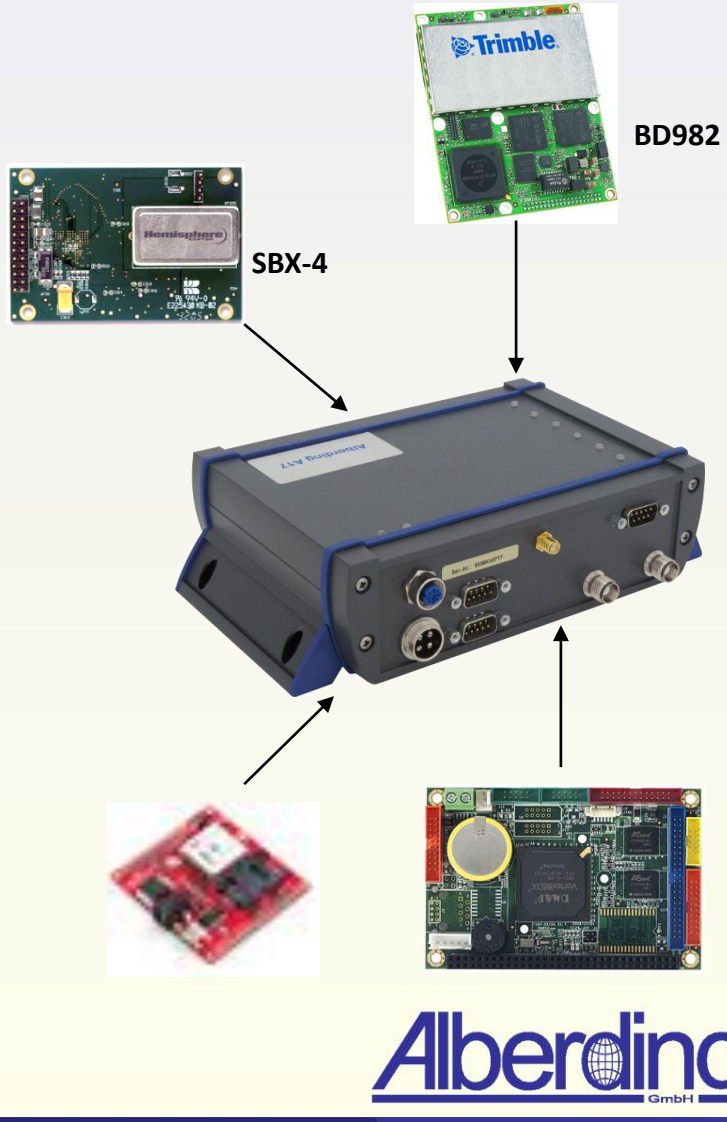
- Dedicated DGNSS monitoring stations (i.e. 200 km from the beacon transmitter)
- Monitoring of
  - Position accuracy (N, E, H)
  - Data age of the corrections
  - SNR of the beacon signal
  - Field strength of the signal
  - Word error rate
- Generation of warning messages (E-mail, SMS) if the values > threshold



Alberding A17 GNSS receiver

Far field monitoring (FFM)

- Integrated GNSS/IPC hardware
  - Scalable GNSS receiver (BD982):
    GPS L1 to GPS, GLONASS, Galileo
    dual receiver system
  - Dual antenna input
  - Embedded computer with Alberding software
  - 2 channel radio beacon receiver (SBX-4)
  - GPRS/UMTS modem
  - 1 Ethernet port, 3 RS232 serial ports
- Antenna connection
  - Antenna 1 (Zephyr II Geodetic)
    - to receiver 1 (RTK base station)
  - Antenna 2 (Trimble GA530)
    - to receiver 2 (DGPS monitor)
    - to beacon receiver (DGPS corrections)



Advantages of the network approach

- **Cost effective**
  - use „normal” GNSS receiver hardware
  - use of reference station data from other governmental institutions (state survey department) and neighbouring countries
- **Future proof**
  - support of new GNSS signals and constellations, RTK, PPP positioning
- **Higher accuracy**
  - enhanced accuracy in local hotspots
- **Supports different data channels**
  - radio beacon, AIS, Ntrip
- **Central Pre-Broadcast Monitoring**
- **Separation of the GNSS network from data transmission**

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Disadvantage of the network approach

- Internet based data communication:
  reliable data links required for data transport from
  - the reference stations to the computing centre
  - the VRS server to the transmitting sites
- Solutions
  - Redundant GNSS input data sources (existing GNSS networks, EGNOS)
  - Redundant communication lines (GPRS/UMTS backup)
  - Monitoring stations can be used as a backup system (Alberding A17)

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Reference

- WSV (German Federal Waterways & Shipping Administration)

  Dipl.-Ing. (FH) Michael Hoppe

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Alberding GNSS Software

Projects

Beacon.net

Future developments

Future developments

- Basic improvements and additional functionality to „Beacon.net”
- Beacon transmitter control module
- Support of new satellite systems (Galileo, COMPASS) and satellite signals (GPS L5)
- Combination of global and regional GNSS information to improve the accuracy (PPP + RA)
- Far field monitoring station with alarming functionality (Alberding A17)
- Web based user information system

Alberding GNSS solutions

Basic features

- Independent from GNSS receiver manufacturers
- Cost effective and reliable
- Designed to run on (Internet) server platforms
- Optimised on functionality
- Adapted to the user requirements
- Visualisation via web interface

We are looking for a long term partnership with our customers!

Thank you for your attention!

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