



The Alberding Beacon.net software

Tamás Horváth
Alberding GmbH

DISC' 13 Belgrade

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Outline



Alberding GmbH

Beacon.net

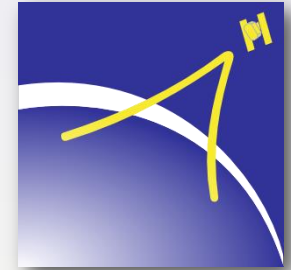
Recent installations

Current development

Alberding GmbH



- German GNSS software development company
- Founded in 1994
- Based in Wildau (near Berlin)
- GNSS software development since 2003
- Integrated GNSS hardware development since 2010
- Independent from GNSS receiver manufacturers



Alberding GmbH experience



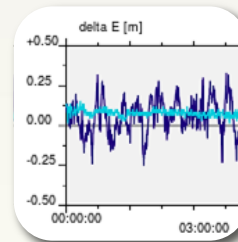
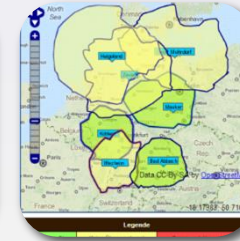
- **Software and system solutions for GNSS infrastructure projects**
 - GNSS data management and processing (EuroRef, EuroNet)
 - GNSS data conversion (DataConv)
 - Monitoring (coordinates, availability, system performance, etc.)
 - Internet based data communication (Ntrip)
 - Customer specific adaptation and system solutions
- **GNSS standardisation** (Ntrip 2.0, RTCM MSM, SSR)
- **Technology development** (PPP, NAV4BLIND)
- **Consulting & studies** (i.e. feasibility studies)
 - VERIPOS (GNSS service quality in a world wide network)
 - Vattenfall Europe Mining AG (RTK performance in open cast mines)
 - via donau (VRS system for inland waterways)



Current projects



- Maritime and inland waterway DGNSS positioning
- GNSS reference station monitoring
- DGNSS/RTK service performance monitoring
- Landslide monitoring
- Machine positioning
- Navigation assistance for the blind
- Validation of GNSS receivers
- Rental of Internet server capacity
- Map server (OSM data)





Alberding GmbH

Beacon.net

Recent installations

Current development

Beacon.net



beacon.net

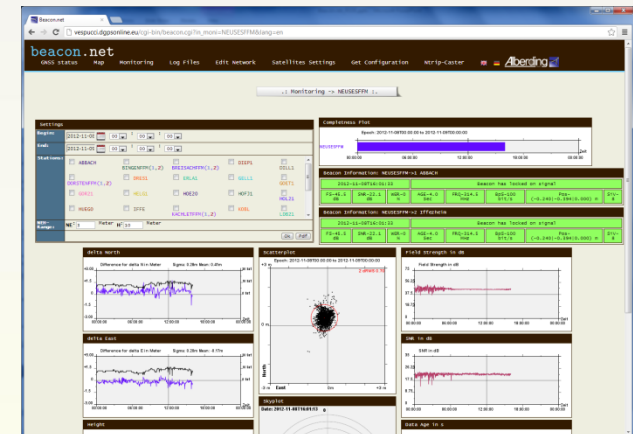
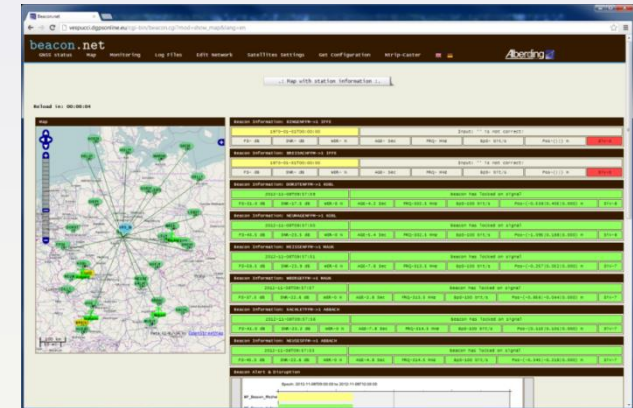
- **Modular GNSS software** designed for the operation of **maritime and inland waterway DGNS services**
- **Virtual Reference Station (VRS) concept**
 - Differential GNSS corrections and integrity information generated at a central site
 - Separating the correction generation from the data transmission technology (radio beacons, AIS, etc.)
 - The VRS solution is in line with the IMO e-Navigation strategy



Alberding Beacon.net modules



- **GNSS raw data input**
 - IALA beacon stations
 - AIS DGPS base stations
 - Other GNSS reference stations
 - Supports GPS and GLONASS
- **VRS server**
 - Network DGNSS processing
 - Generation of virtual corrections
 - No GNSS receiver needed at transmission sites
- **Integrity monitoring**
 - Before transmission (position and SV domains)
 - Far field monitoring (position and signal quality)
- **Data transmission**
 - IALA radio beacons, AIS, Ntrip (GPRS, WLAN)
 - RTCM 2.x, 3.x, AIS Type #17



Beacon.net with EGNOS



Data conversion module

- EGNOS RTCA data conversion to RTCM corrections for user definable positions: **“EGNOS VRS”**
- Input data sources:
 - EGNOS enabled GNSS receiver
 - EDAS (EGNOS Data Access Service) via IP
- Rebroadcast via
 - IALA radio beacons, AIS, Ntrip
- EGNOS is a free service
- Can be used as a backup solution to conventional DGNSS





Alberding GmbH

Beacon.net

Recent installations

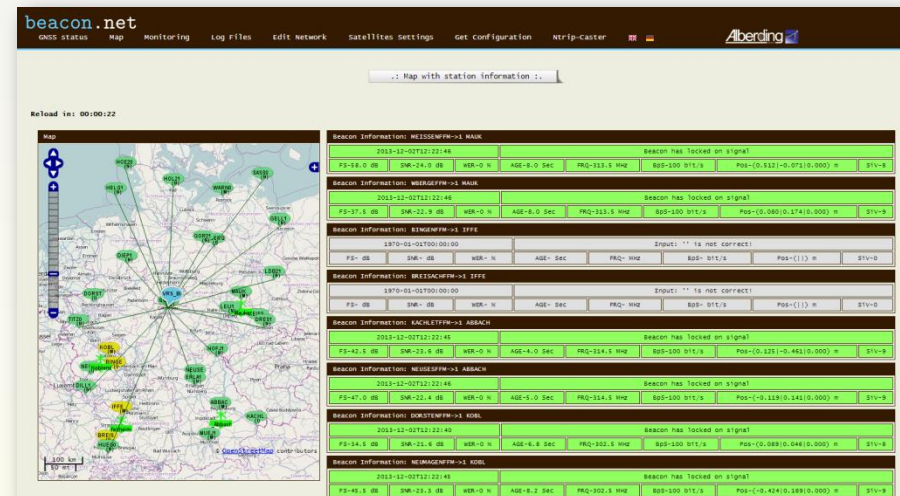
Current development

WSV VRS system



In operation since 2011

- 16 GNSS raw data input streams
 - GREF, EPN reference stations
- Central VRS processing
- 7 Pre-Broadcast Monitoring stations
- 4 IALA DGPS beacons
 - Koblenz, Mauken, Iffezheim, Bad Abbach
- 8 Far Field Monitoring stations
- Ntrip Caster



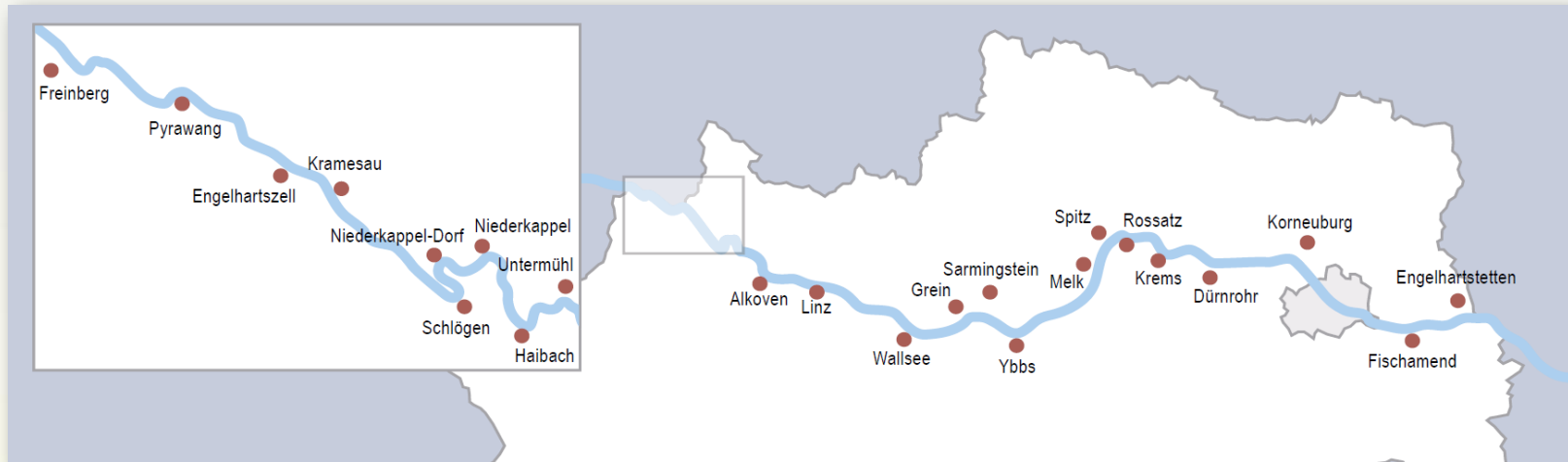
Complete Beacon.net system in Austria



Previous status at via donau (DoRIS):

- 23 AIS base stations
- 2 AIS DGPS base stations (Alkoven, Korneuburg)
- No integrity monitoring

viadonau



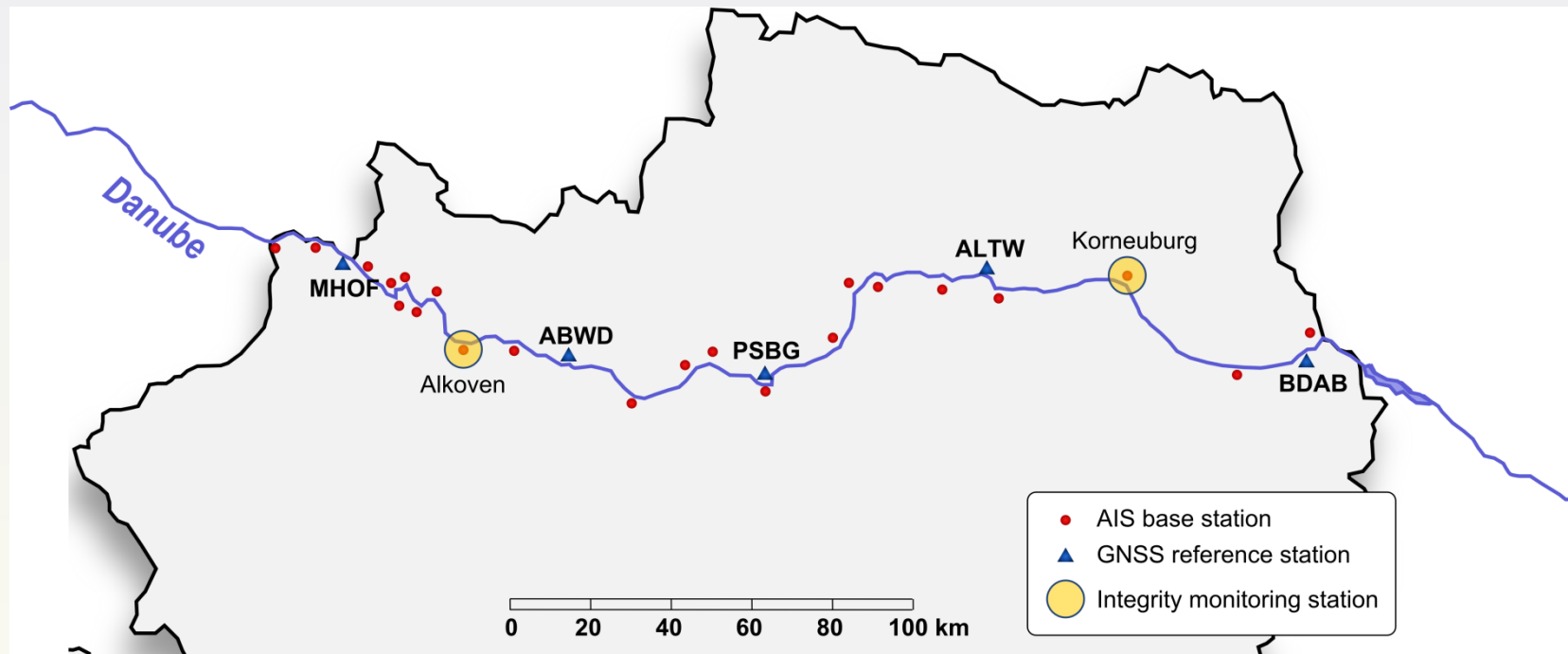
Complete Beacon.net system in Austria



Virtual Reference Station system installation (2013):

- 5 new GNSS reference stations
 - Maierhof, Abwinden, Persenbeug, Altenwörth, Bad Deutsch Altenburg
 - L1/L2/L5 GPS+GLONASS receivers with raw data output (sw upgraedable to Galileo)
- Central VRS DGNSS processing
- 23 individual RTCM correction streams for the AIS base stations
- Pre-Broadcast Monitoring of the corrections for each site
- Far Field Monitoring at 2 dedicated monitoring stations
 - (Alkoven, Korneuburg)
- Ntrip Caster
 - high accuracy RTK data distribution
- Central web interface
 - configuration, monitoring, alarming

via donau station distribution



via donau system installation



SUMMARY MONITORING SATELLITE SETTINGS SETUP - SYSTEM GET EURONET.CFG SETUP - INTERFACE LOG FILES Euronet Process Euronet Cron beacon.net

Status with station information

Reload in: 00:00:41 [stop]

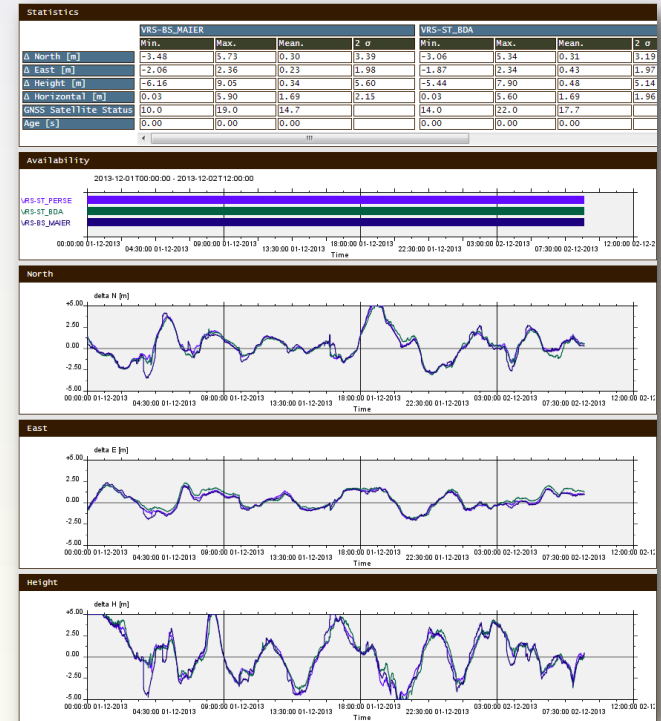
Output Information

Output	Monitoring-Status (PBM)	Correction-Status	Last Error PRC/RRC

Input Information

Station	Availability	N	E	H	Age	GNSS Satellite Status
Inputs unused						
VRS-BS_MAIER	2013-12-02T08:46:18	0.33	0.95	0.50	-	G03 G06 G07 G16 G18 G19 G21 G22 G27 R01 R07 R08
VRS-ST_BDA	2013-12-02T08:46:19	0.59	1.22	0.11	-	G03 G06 G07 G15 G16 G18 G19 G21 G22 G27 R01 R07
VRS-ST_PERSE	2013-12-02T08:46:19	0.57	1.01	0.45	-	G03 G06 G07 G15 G16 G18 G19 G21 G22 G27 R01 R07

Beacon.NET ::: Alberding GmbH ::: Schmiedestraße 2 ::: 15745 Wildau ::: info@alberding.eu ::: +49 (0) 3375 / 52 50 370



Far Field Monitoring in Poland



DGPS-PL system

- Maritime Office in Gdynia
- 2 existing IALA beacons with RSIM
 - Dziwnów, Rozewie



Alberding GmbH (2013):

- 3 Far Field Monitoring stations
 - Swinoujscie, Jaroslawiec, Gdansk
- 2 RTK base stations
 - Gdansk, Swinoujscie
- Ntrip Caster
 - Data collection
 - RTK correction broadcasting



Beacon.net web interface in Poland



Map showing station locations in Poland: GDAN_ROZ, JARO_DZI, JARO_ROZ, and SWIN_DZI.

..: Status with station information ..

Reload in: 00:00:28

..: Real-Time Information ..

Beacon Information: GDAN_ROZ [Rozewie] | FRQ-301.0 MHz | BpS-100 bit/s

16:43:49 29-11-2013 Beacon has locked on signal

SS 47.0 dB SNR 33.0 dB WER 0 % AGE-10.2 Sec 2 σ 0.16m SIV 8 HDOP 1.1

Beacon Information: JARO_DZI [Dziwnow] | FRQ-283.5 MHz | BpS-100 bit/s

16:43:49 29-11-2013 Beacon has locked on signal

SS 34.0 dB SNR 23.0 dB WER 0 % AGE-9.8 Sec 2 σ 0.28m SIV 8 HDOP 1.1

Beacon Information: JARO_ROZ [Rozewie] | FRQ-301.0 MHz | BpS-100 bit/s

16:43:49 29-11-2013 Beacon has locked on signal

SS 34.0 dB SNR 21.0 dB WER 0 % AGE-9.2 Sec 2 σ 0.18m SIV 8 HDOP 1.1

Beacon Information: SWIN_DZI [Dziwnow] | FRQ-283.5 MHz | BpS- bit/s

16:43:49 29-11-2013 Searching for signal

SS 0.0 dB SNR 0.0 dB WER 0 % AGE-59.8 Sec 2 σ 1.15m SIV 6 HDOP 2.3

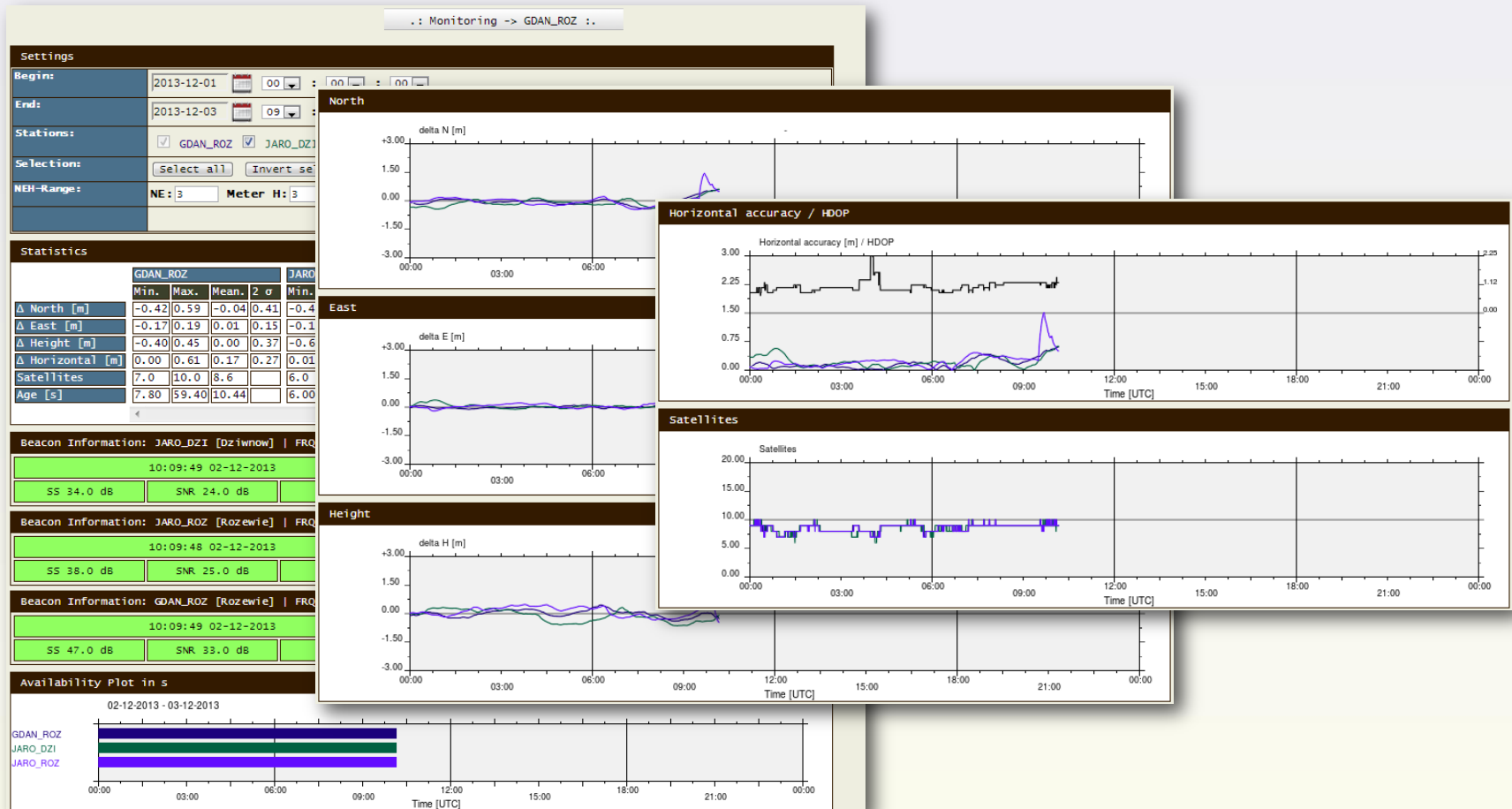
Beacon Alert & Disruption

29-11-2013 - 30-11-2013

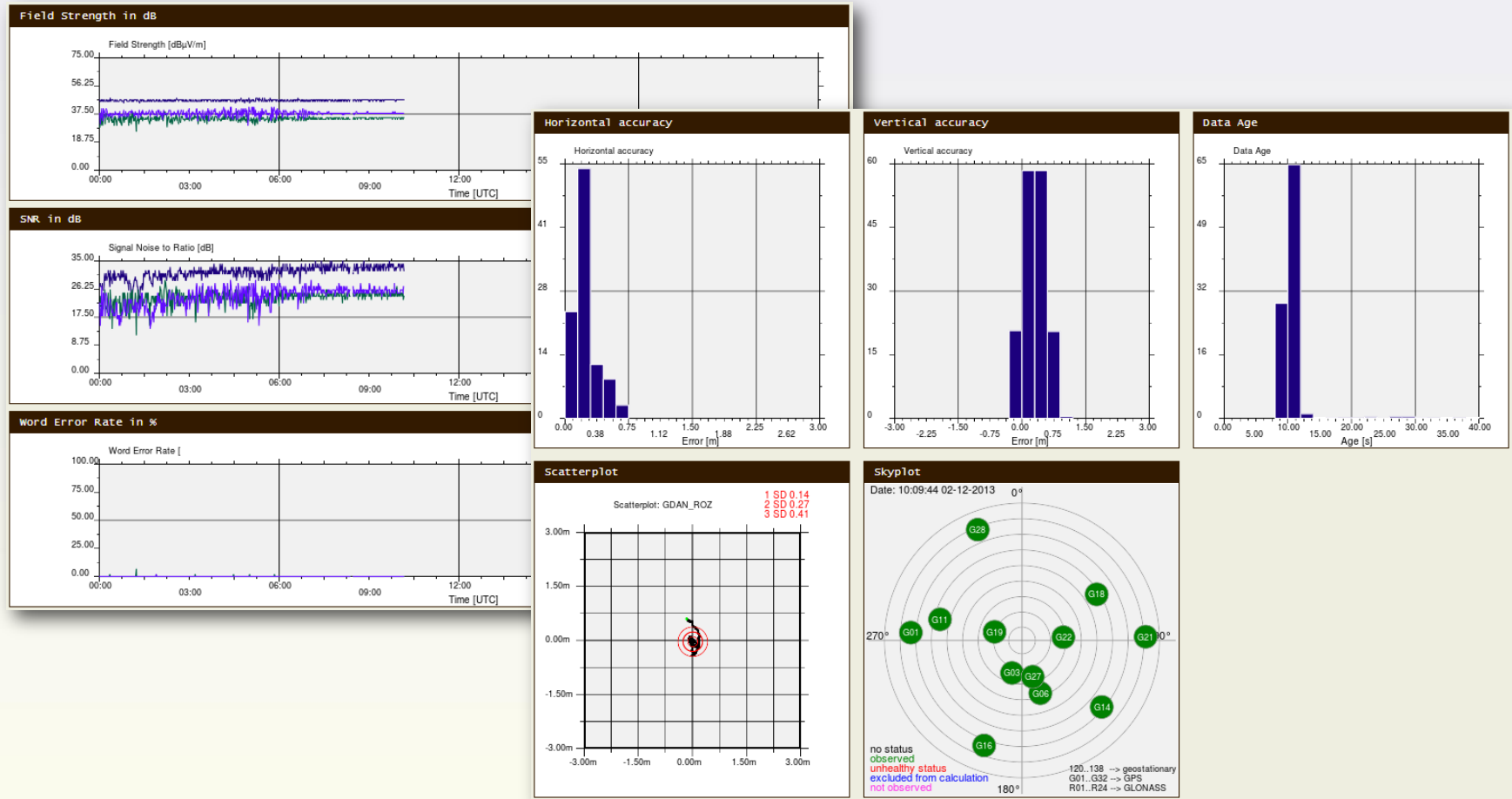
Input Information

Station	Status	N	E	H	Satellites								
GDAN_ROZ (N)	2013-11-29T16:43:49	-0.01	-0.16	-0.07	G02	G04	G07	G10	G13	G16	G20	G23	G32
JARO_DZI (N)	2013-11-29T16:43:49	0.28	0.04	-0.18	G02	G04	G07	G10	G13	G16	G20	G23	G32
JARO_ROZ (N)	2013-11-29T16:43:49	0.17	0.06	0.44	G02	G04	G07	G10	G13	G16	G20	G23	G32
SWIN_DZI (N)	2013-11-29T16:43:49	-0.63	0.96	1.29	G02	G04	G07	G10	G13	G16	G20	G23	

Performance monitoring in Poland






Performance monitoring in Poland



Beacon.net alarm settings (Poland)



beacon.net

[GNS Status](#)
[Map](#)
[Real-Time Information](#)
[Statistics/History](#)
[Log Files](#)
[Setup](#)
[Satellite Settings](#)
[Get Configuration](#)
[Ntrip-Caster](#)




.. Edit -> GDAN_ROZ Rozewie ..

Delete	User Name	[active] Mail	[active] SMS	Delay Epoch	2DRMS (Time)	Satellites (Time)	Data Age (Time)	Field Strength (Time)	Signal to Noise Ratio (Time)	Word Error Rate (Time)
<input type="checkbox"/>	<input type="text"/>	<input type="checkbox"/> <input type="text"/>	<input type="checkbox"/> <input type="text"/>	120 [s] (0 [s])	5 [m] (60 [s])	5 [#] (60 [s])	20 [s] (60 [s])	34 [dB] (60 [s])	7 [dB] (60 [s])	30 [%] (60 [s])
<input type="checkbox"/>	Darek <input type="text"/>	<input checked="" type="checkbox"/> dariusz. <input type="text"/>	<input type="checkbox"/> +48 <input type="text"/>	120 [s] (0 [s])	5 [m] (60 [s])	5 [#] (60 [s])	20 [s] (60 [s])	34 [dB] (60 [s])	7 [dB] (60 [s])	30 [%] (60 [s])

Edit default values by no input for new user in mail and user name!

Beacon.net - UMGDY ::: Alberding GmbH ::: Lilienthalstraße 25 ::: 12529 Schönefeld ::: info@alberding.eu ::: +49 (0) 30 / 678 260 60



Integrity monitoring in Hungary



Current status at RSOE (PannonRIS):

- 11 existing AIS base stations
- 3 AIS DGPS base stations (2 active)
- No integrity monitoring



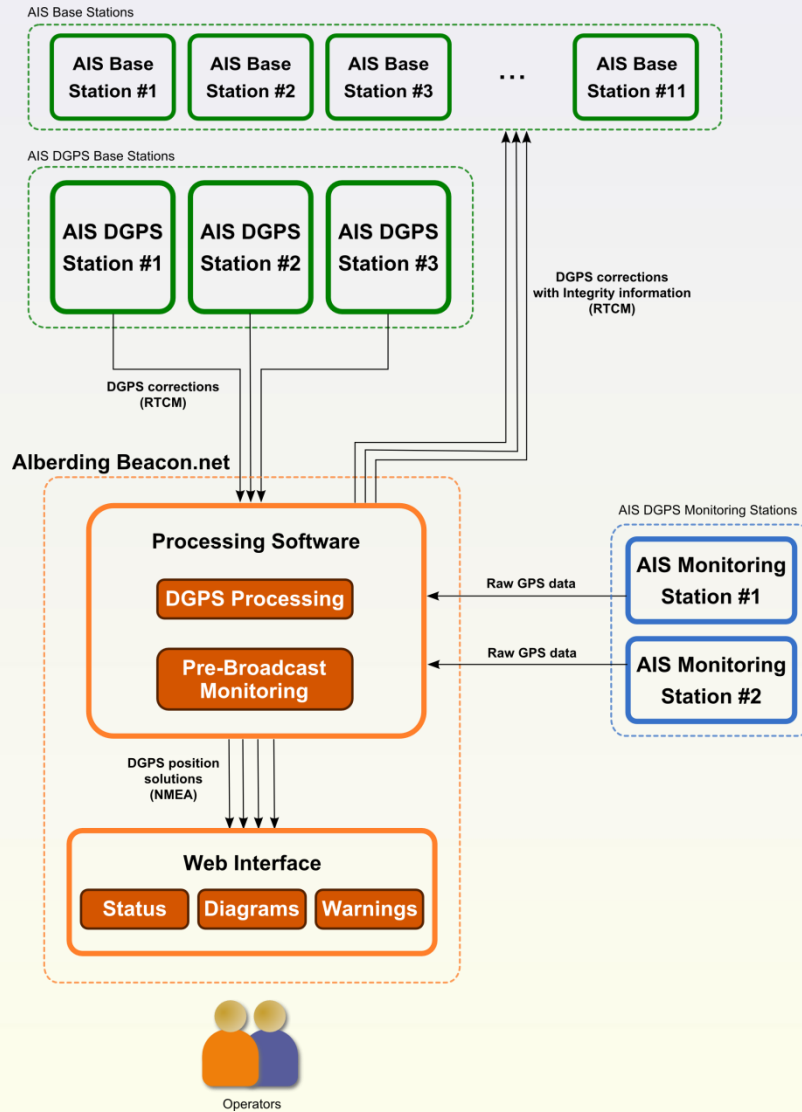
Alberding GmbH (2013-14):

- Pre-Broadcast Monitoring
 - Monitoring stations in Budapest and Paks
- DGPS performance evaluation
 - AIS DGPS vs IALA DGPS vs EGNOS



Alberding
GmbH

System architecture in Hungary



EGNOS performance monitoring



Trinity House (Harwich, UK) study

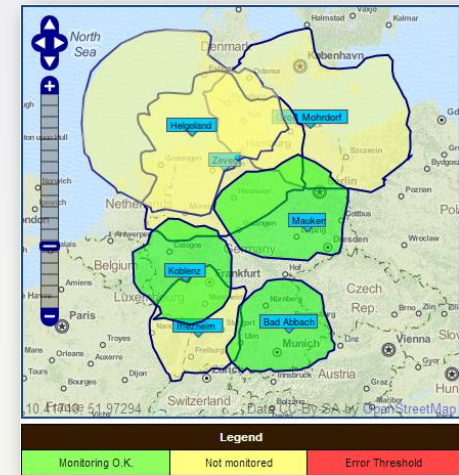
- EGNOS performance at the borders of the coverage area
- EDAS SISNeT input
- RTCM v2.x correction output for user defined locations
- Alberding DataConv software
RTCA → RTCM
- Positioning by standard DGNSS hw
- Evaluation by Trinity House



User information tool



- Web-based tool to provide DGNSS status information to registered users
 - Integrity monitoring status
 - Coverage area
 - Positioning accuracy
 - Correction data age
 - MF signal quality (Field strength, SNR, WER)



System Status

Sender	FFM 1	FFM 2	Frequency [kHz]	Reference Station ID	Data Rate [bits]	Range [km] (34dB/1vm)	Status
Mauken (Elbe)	Meißen	Wittenberge	313.5	766	100	225	Wirkbetrieb

Information about transmitter **Mauken** (51° 43' N 12° 49' E)

GNSS-Correction data

- DGPS - DGLONASS (VRS)
- Generated from VISV reference network
- Data format RTCM SC 104 (Message types: 9,3,6,7,16,31,34)

Monitoring

- Prebroadcast Monitoring at transmitter
- Farfield Monitoring at stations
 - Meißen (N 51° 10 262' | E 13° 28 592')
 - Wittenberge (N 52° 59 418' | E 11° 45 191')

Beacon Information: MEISSENFMM - MAUK

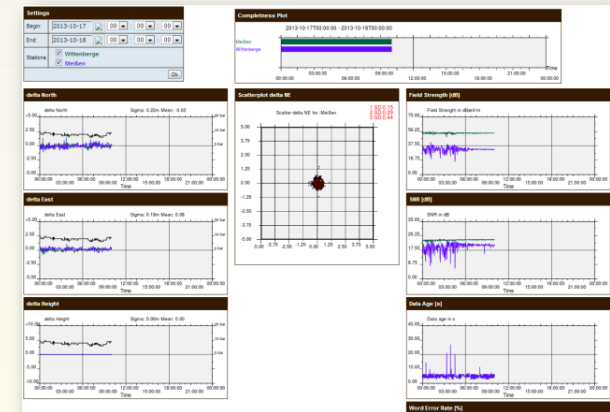
2013-10-17T10:00:58 [UTC]	Beacon has locked on signal				
FS-54.0 dB	SNR-23.9 dB	WER-0 %	AGE-6.2 Sec	Pos-(0.341 0.392 0.000) m	SN-9

Beacon Information: WBERGEFMM - MAUK

2013-10-17T10:00:58 [UTC]	Beacon has locked on signal				
FS-32.5 dB	SNR-20.6 dB	WER-0 %	AGE-6.2 Sec	Pos-(0.184 0.258 0.000) m	SN-9

Legend: Monitoring O.K. (green), Not monitored (yellow), Error Threshold (red)

Signal strength: inside limit 34dB/1vm, outside limit 26dB/1vm



User information tool "Start"



- Start
- Registration
- System Status
- Impressum

DGSS reference stations of the German Federal Waterways and Shipping Administration (WSV)

The WSV reference stations provide a reliable correction data service with high accuracy, availability and integrity for safety-critical navigation applications through MF radio beacons. The accuracy of the service is typically $\leq 1-3\text{ m}$. The integrity monitoring system warns users of erroneous information provided by the satellite navigation system with an alarm time of less than 10 seconds. The WSV DGSS service is based on a global standard method, developed by the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA). The service is internationally known as "IALA DGPS" or "MF Radio Beacon".

The map provides information about the current operating status of the WSV DGSS reference stations. Transmitter location data is provided for the coastal and inland network sites, together with transmitter range information based on a signal propagation calculation with a field strength cutoff value of $34\text{ dB}\mu\text{V/m}$. Within the displayed coverage area the DGSS service can be used with high availability. The service can also be used at greater distances with lower field strength.

Service monitoring of each reference station is carried out using two permanently installed DGPS receivers, operated at a distance of about 100 km from the transmitter site. These so-called Far Field Monitor (FFM) stations continuously monitor the current position accuracy (known-actual comparison) and the quality of the MF signal. If predefined threshold values are exceeded, an alarm is automatically set off to warn system operators. The current system status is indicated on the map with colour codes. Currently the monitoring data of the inland network sites (Bad Abbach, Koblenz and Mauken) is available online.

In the password protected part of the website more information is provided on the DGSS service, as well as on the actual status of the Far Field Monitor stations. Registered users receive additional information on scheduled service maintenance via email.

Legend

Monitoring O.K.	Not monitored	Error Threshold
-----------------	---------------	-----------------

[Registration](#)

The „Start“ menu is visible for everybody

User information tool “Registration”



Start
Registration
System Status
Impressum

WSV.de
Wasser- und
Schiffahrtsverwaltung
des Bundes

User Registration for WSV Beacon.net interface

User registration gives you access to status information of the permanent monitoring stations. These stations provide data on the current status, performance and coverage area of a reference station. Furthermore, after registration, on request you will receive email information about changes at the stations and on planned system downtimes!

Please use only standard ASCII characters.

Registration

Family Name*:	<input type="text"/>	First Name*:	<input type="text"/>
Company / Organization / Agency other*:	<input type="text"/>		
E-Mail*:	<input type="text"/>		
User Name*:	<input type="text"/>	Password*:	<input type="text"/>
Application*:	Your application, detailed specification		
Preferred Stations:	<input type="radio"/> Bad Abbach (Donau) <input type="radio"/> Iffezheim (Rhein) <input type="radio"/> Koblenz (Rhein) <input checked="" type="radio"/> Mauken (Elbe)		
Receiver:	<input type="text"/>		


Fields with an "*" must be filled out!

By submitting this form you confirm your personal information and accept the conditions mentioned here.

For more information the users have to “register”

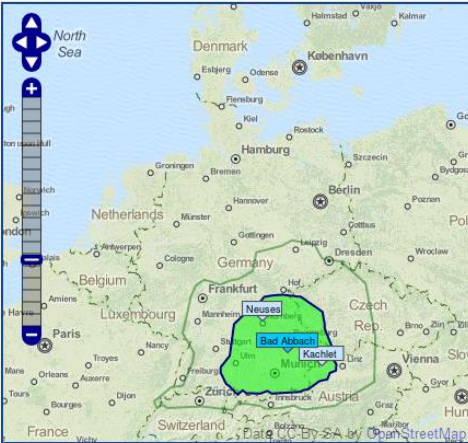
User information tool "System Status"





Start | Registration | System Status | Impressum

System Status



Legend

Monitoring O.K.	Not monitored	Error Threshold
-----------------	---------------	-----------------

Signal strength: inside limit 34dBµV/m, outside limit 26dBµV/m

Sender	FFM 1	FFM 2	Frequency [kHz]	Reference Station ID	Data Rate [Bit/s]	Range [km] (34dBµV/m)	Status
Bad Abbach (Donau)	Neues	Kachlet	314.5	765	100	225	Wirkbetrieb


Information about transmitter **Bad Abbach** (48° 56' N 12° 02' E)

GNSS-Correction data

- o DGPS + DGLONASS (VRS)
- o Generated from WSV reference network
- o Data format RTCM SC 104 (Message types: 9,3,6,7,16,31,34)

Monitoring

- o Prebroadcast Monitoring at transmitter
- o Farfield Monitoring at stations:
 - Kachlet (N 48° 34.896' | E 13° 24.461')
 - Neues (N 49° 46.532' | E 11° 01.396')



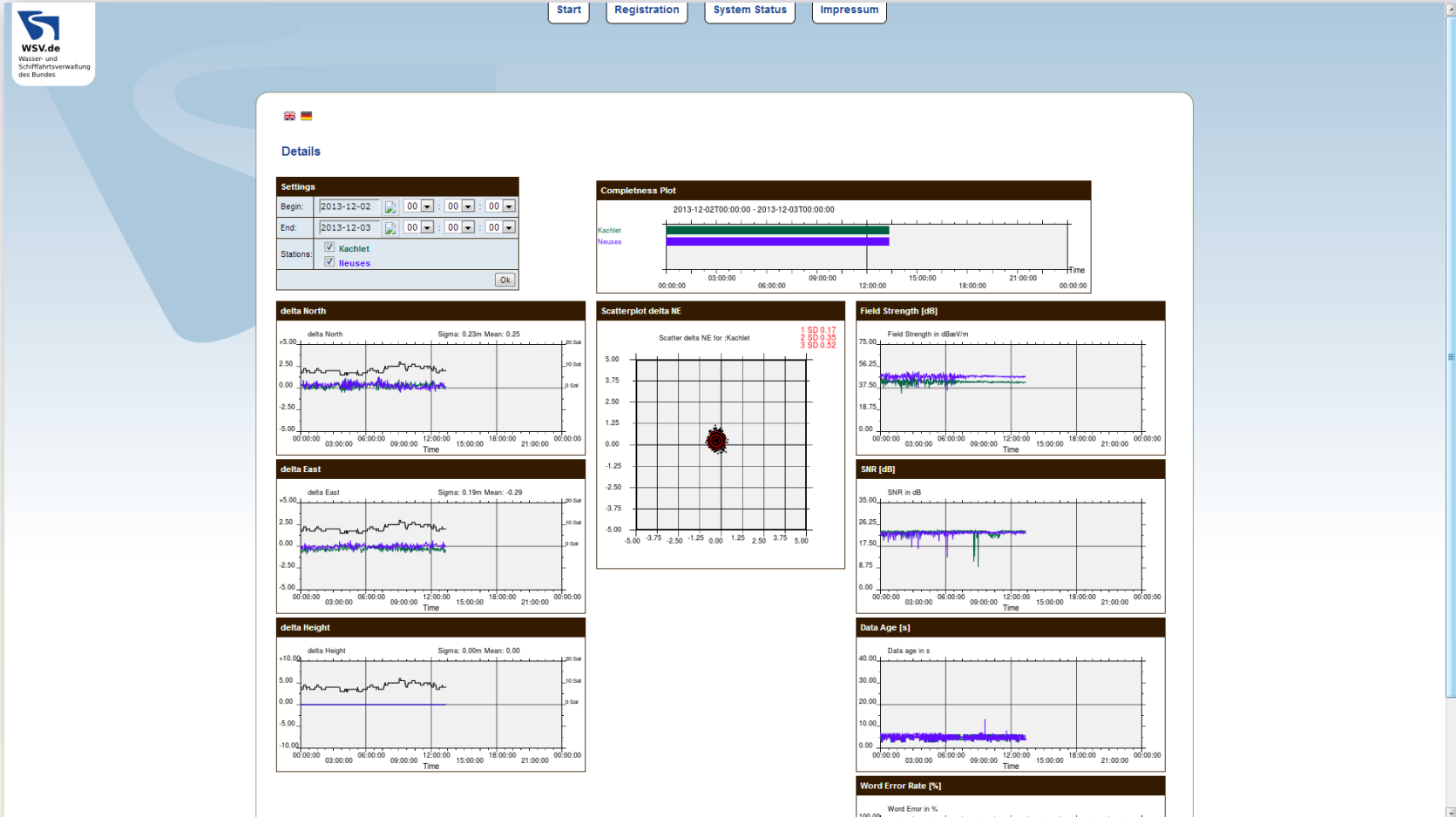
Details

Beacon Information: KACHLETFM - ABBACH					
2013-11-29T16:51:49 [UTC]			Beacon has locked on signal		
FS-42.5 dB	SNR-23.5 dB	WER-0 %	AGE-5.0 Sec	Pos-(-0.599 -0.340 0.000) m	SIV-8

Beacon Information: NEUSEFFM - ABBACH					
2013-11-29T16:51:58 [UTC]			Beacon has locked on signal		
FS-49.0 dB	SNR-23.4 dB	WER-0 %	AGE-6.2 Sec	Pos-(-0.606 0.091 0.000) m	SIV-8

The system status page provides real-time information from the FFM stations

User information tool “Details”



The detailed plots provide all the FFM information



Alberding GmbH

Beacon.net

Recent installations

Current development

R-Mode feasibility study



In the framework of the **ACCSEAS** project (e-Navigation in the North Sea)
Alberding GmbH together with Alion Science and Technology

R-Mode motivation:

- GNSS vulnerable to intentional and unintentional interference
- Need for resilient PNT (robust, reliable and dependable)
- In line with the e-Navigation strategy

R-Mode positioning technique:

- Ranging mode, allows for range determination based on time of arrival (TOA) measurements
- Different systems provide time of emission (TOE) broadcasts
- Ranging signals from MF radiobeacons, AIS and eLoran
- “All in view” receivers
- Redundant positioning (backup PNT to GNSS)



R-Mode positioning concept



The vision: integrated solutions for PVT



**PVT =
Position
Velocity
Time**

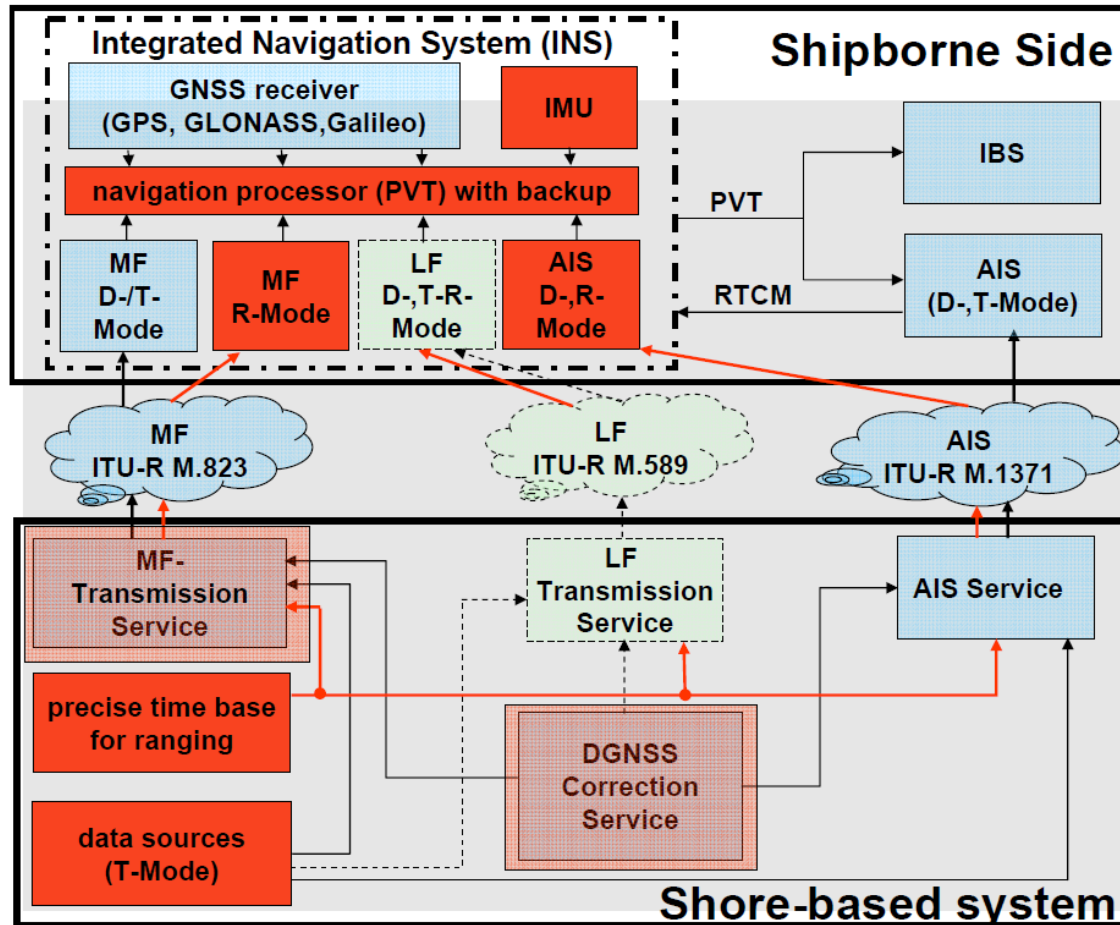


Image source:
Jan-Hendrik Oltmann,
Michael Hoppe
(WSV)

Under development



- New generation reference station receiver
- Alberding A17
- **Primary functions:**
 - **DGNSS monitoring station**
 - RTCM DGNSS correction input
 - NMEA position output
 - L1 raw data output
 - **RTK reference station**
 - RTCM RTK correction generation and output via Ntrip or local VHF radio transmitter
 - L1/L2/L5 raw data output via Ntrip
- **Backup function:**
 - **DGNSS reference station**
 - RTCM DGNSS correction generation and output via local transmitter

Alberding A17



- Trimble BD982 (scalable) GNSS receiver
- 2 x 220 channels,
- GPS L1 to GPS, GLONASS, Galileo
- Dual GNSS antenna input
- GPRS/UMTS modem
- Integrated PC with Alberding sw
- Internal 2 channel beacon receiver (optional)
- Ethernet port



Thank you for your attention!

Contact:

Tamás Horváth

Alberding GmbH
Schmiedestraße 2
D-15745 Wildau
Tel.: +49 3375 52 50 370
Fax: +49 3375 52 50 377
Web: www.alberding.eu

Office in Hungary
1139 Budapest, Petneházy u. 50-52.
Tel.: +36 1 7843 813
Mobile: +49 151 188 048 99
E-Mail: horvath@alberding.eu