NAVWAT

Future high precision navigation system for inland waterways

Philipp Berglez
Managing Partner & CTO

TeleConsult Austria GmbH
Schwarzbauerweg 3,
A-8043 Graz, Austria

pberglez@teleconsult-austria.at
www.teleconsult-austria.at
Phone: +43-316-890971-14

Content

- Overview
- Project goals
- Application scenarios
- System architectures
- User terminal design
- NAVWAT & RIS
- GNSS performance
- Conclusion

Overview

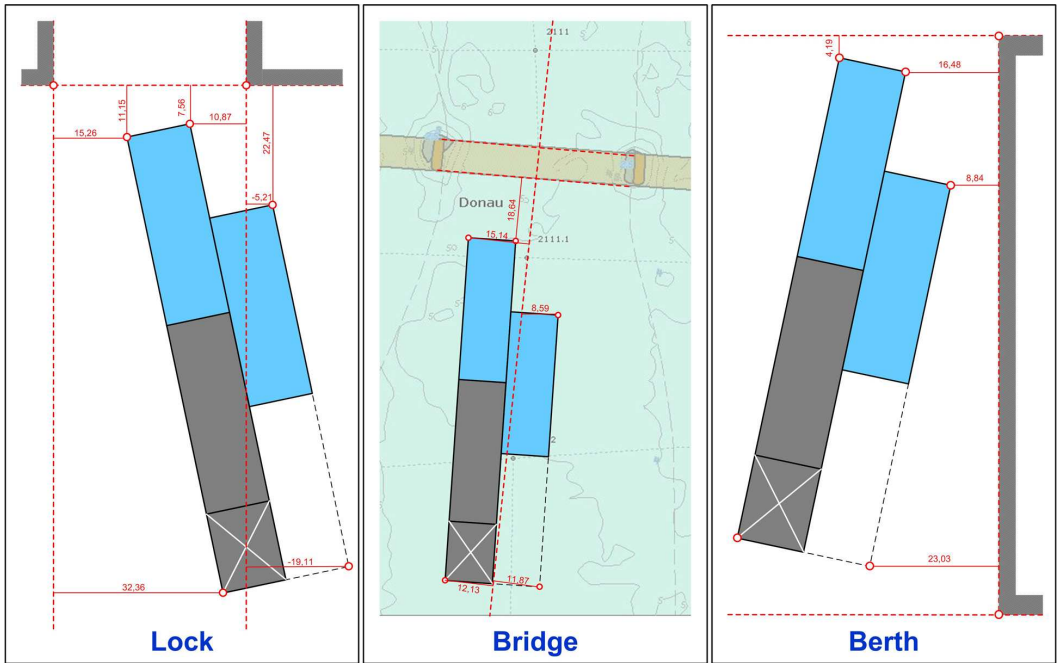
- NAVWAT was a concept study investigating new applications for GNSS systems in the inland navigation business focusing especially onto a visual guidance support system
- NAVWAT 2 is the follow up project focusing onto a first prototype system
- Project partners
  - TeleConsult Austria GmbH, Austria
  - via donau - Österreichische Wasserstraßen-Gesellschaft mbH, Austria
- Funding
  - Federal Ministry for Transport, Innovation and Technology (bmvit) through the Austrian Space Application Programme

Project goals

- Development of a high precision navigation system based on GNSS (Global Navigation Satellite System) positioning and tailored to the use for barge convoys and cargo vessels in inland navigation
- The user terminal to be developed will provide visual guidance support for approaching river locks, passing under bridges, and approaching riverside berths and ports

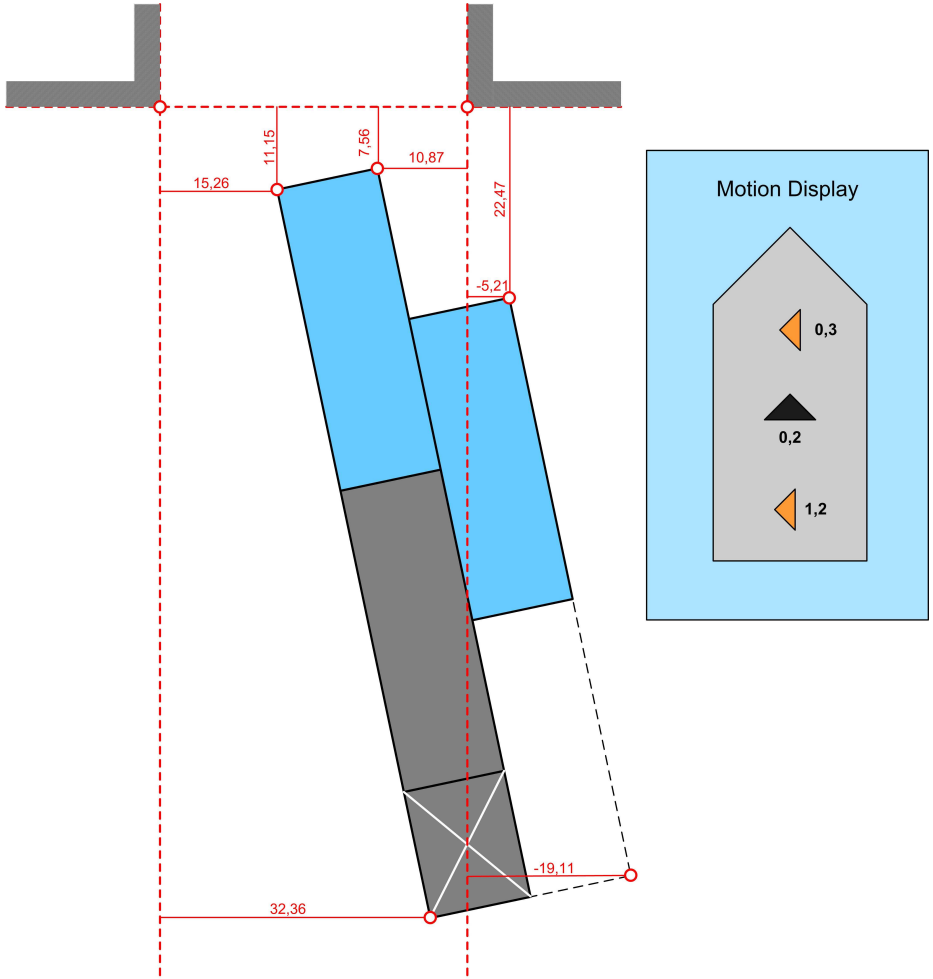
Application scenarios (1/2)

- **Navigation support for critical navigation situations**
  - Approach to river locks
  - Passing bridges
  - Approach to berths



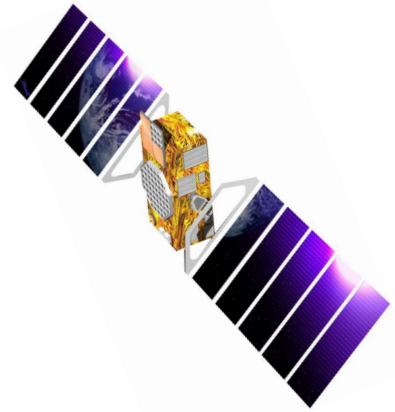
Application scenarios (2/2)

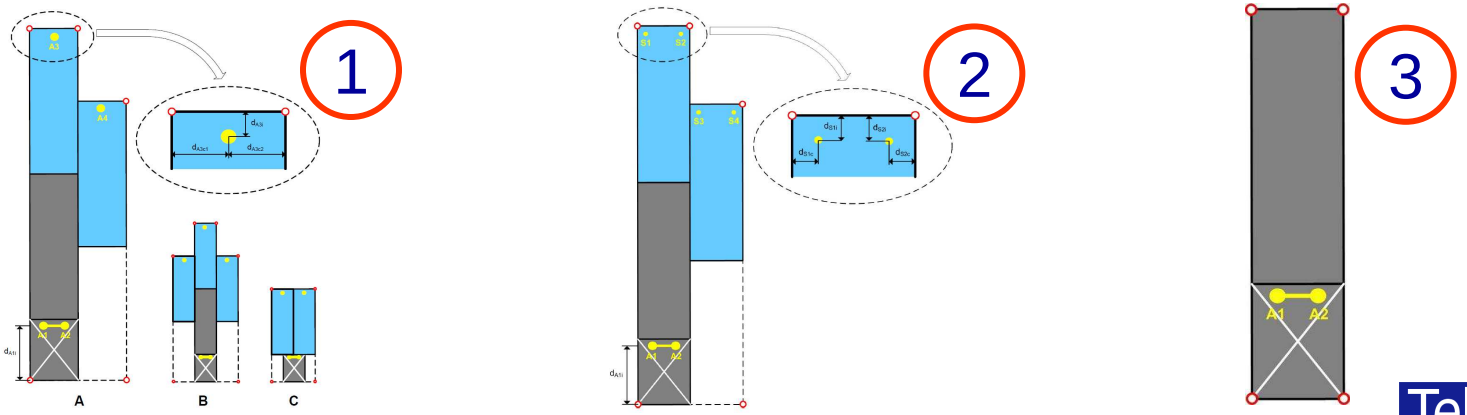
- **Implementation (Example: approach to a river lock)**
  - Graphical display of situation (preferably in ECDIS Viewer)
  - Distance information between vessel hull and lock infrastructure
  - Velocity information (Motion Display)



System architectures (1/5)

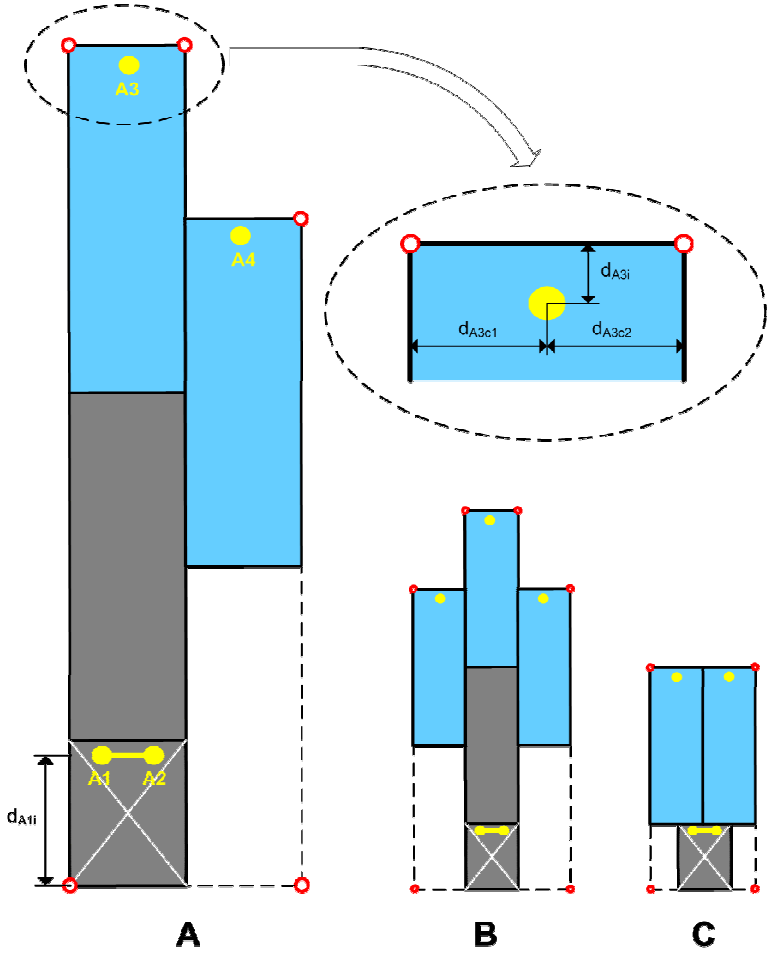
- **The system consists of two main parts**
  - Main positioning system (push boat unit)
  - Relative positioning system (barge/survey unit)
- **The following different architectures are possible**
  - Architecture 1: Convoys using a barge unit
  - Architecture 2: Convoys using a survey unit
  - Architecture 3: Motorised cargo vessels





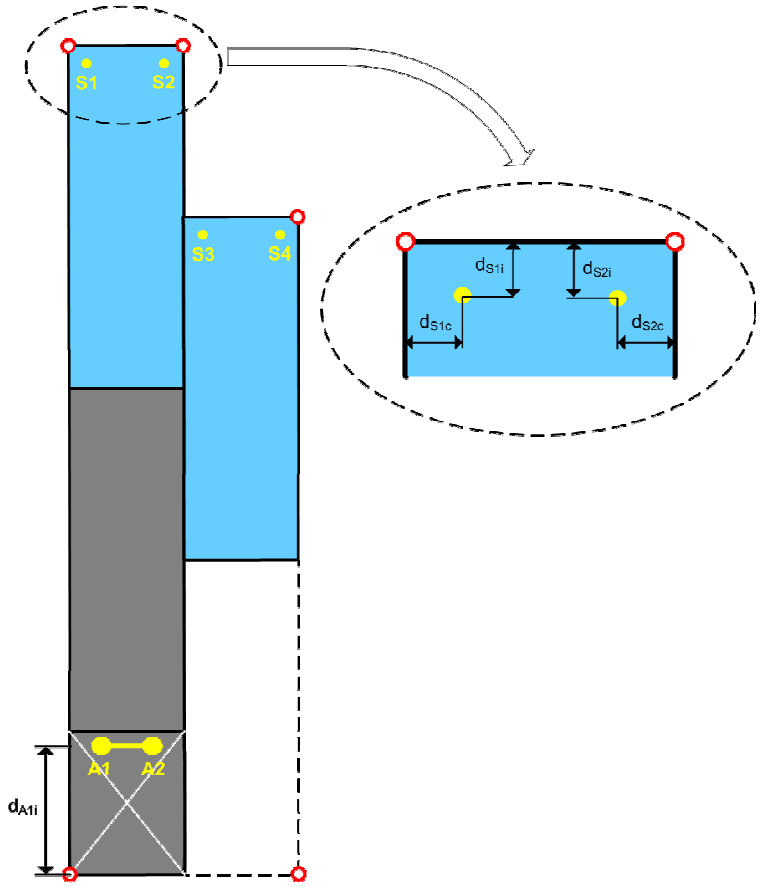
System architectures (2/5)

- **System architecture 1**
  - GNSS units mounted on barge (not permanently)
  - Computation of reference points (corner points) using known offsets and vessel heading
  - Plus: Positioning accuracy independent from length of convoy, best achievable accuracy
  - Minus: Need for power supply and mounting spot on barges



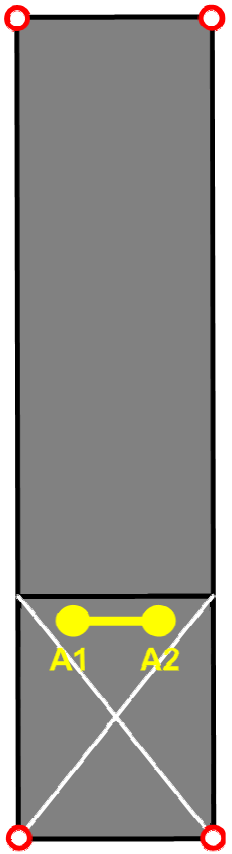
System architectures (3/5)

- **System architecture 2**
  - After configuration of convoy, characteristic points (survey points) at the barges are measured with an RTK-like system
  - Computation of reference points (corner points) using known offsets and vessel heading
  - Plus: No GNSS units mounted on barge
  - Minus: Accuracy of reference points dependant on the accuracy of the initial survey and on the heading information during operation



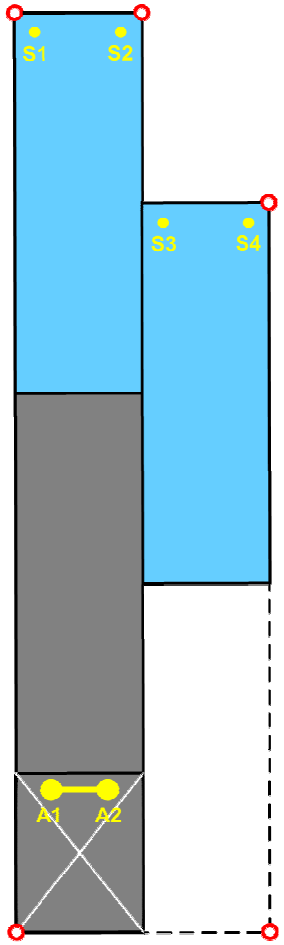
System architectures (4/5)

- **System architecture 3**
  - Simplified version for motorised cargo vessels
  - Computation of reference points (corner points) using known offsets and vessel heading
  - Plus: Simple concept and installation, lower equipment price
  - Minus: Accuracy of reference points dependant on the accuracy of the heading during operation

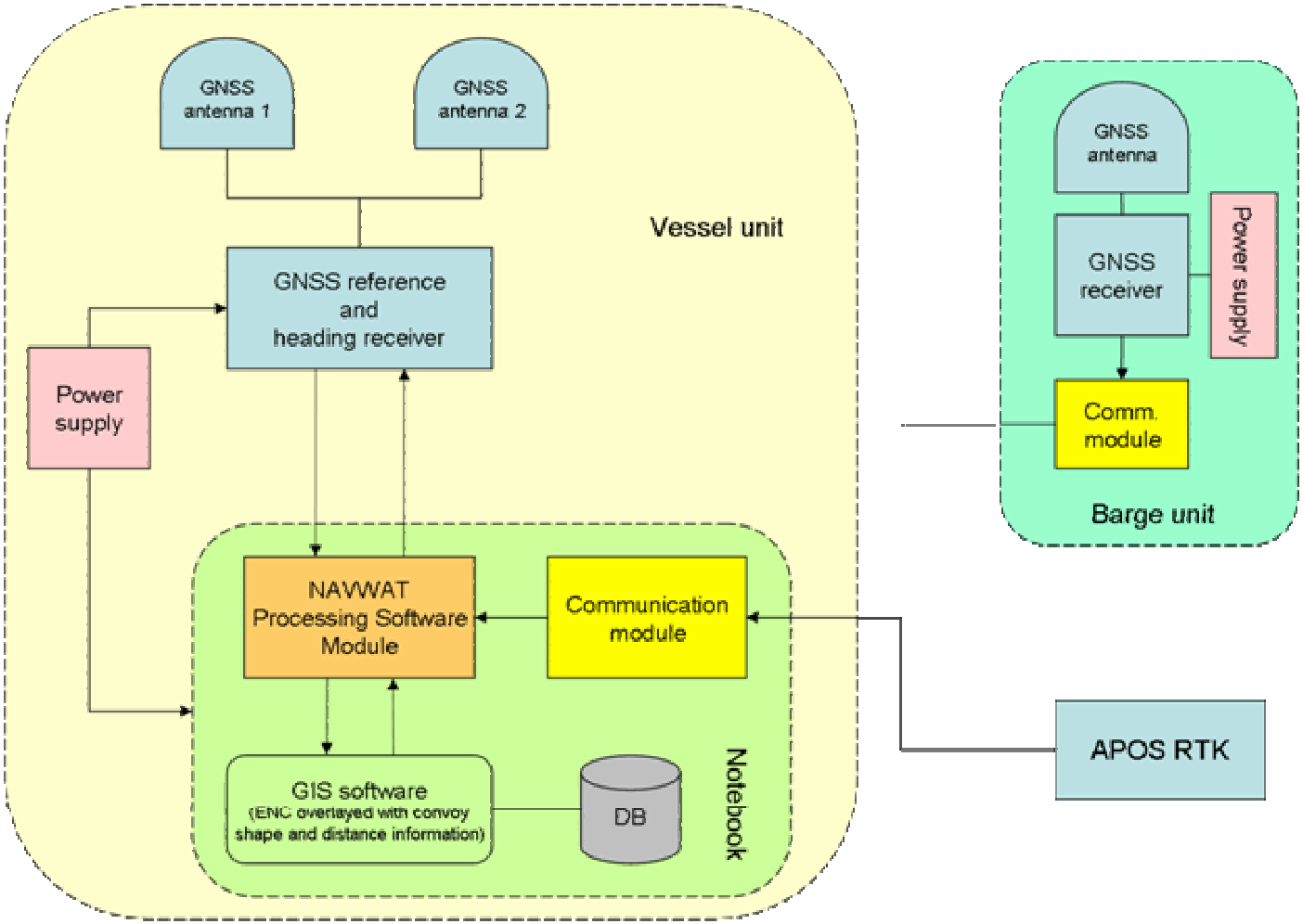


System architectures (5/5)

- **Convoy shape determination**
  - Measurement of relative position on characteristic points
  - Computation of reference points based on offsets and heading
  - Definition of the mathematical shape of the convoy by the software
  - Final check by vessel crew

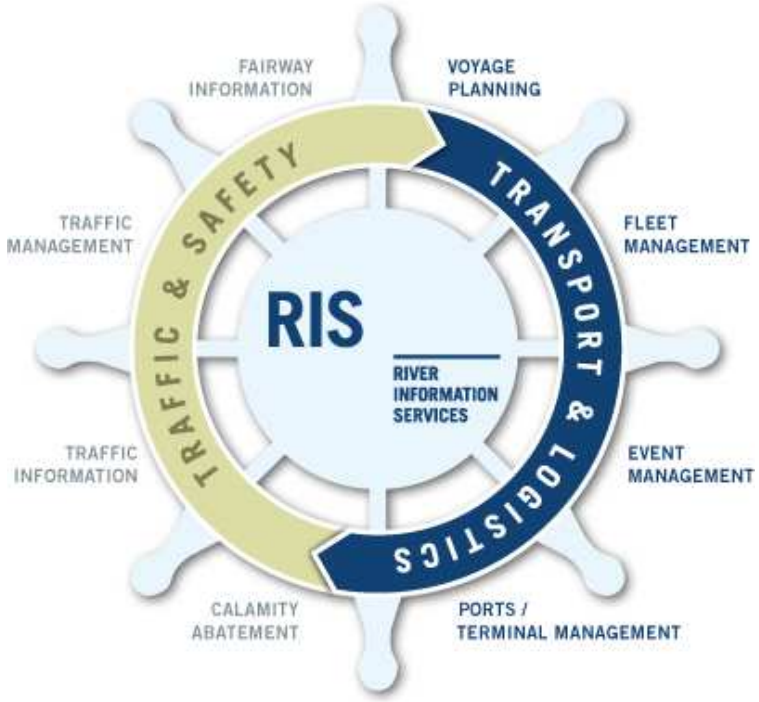


User terminal design



NAVWAT & RIS

- **Integration into River Information Services (RIS) concept**
  - Position and heading information forwarded to AIS transponder
  - Automatic update of convoy dimension in Inland AIS transponder
    - After each convoy shape determination and the assessment through vessel crew the new convoy shape is sent to the AIS transponder automatically



GNSS performance

- **The following GNSS performance requirements have been established**

NAVWAT User Requirements		
Application		**User needs**
Future high precision navigation system for inland waterways	Accuracy	0,1 m
	Availability	99.9 %
	Alarm limit	0,25 m
	TTA	2 s
	Integrity risk	10^{-5}/3 h
	Continuity	99.97% / 15 min
	TTFF Reacquisition	not critical 2 s
	Heading	< 0,1°

Currently conventional RTK positioning is used (GPS stand-alone).

In the future, the suitable positioning technology will be WARTK provided By EGNOS / EDAS. WARTK helps reducing Costs (service fees and infrastructure costs.

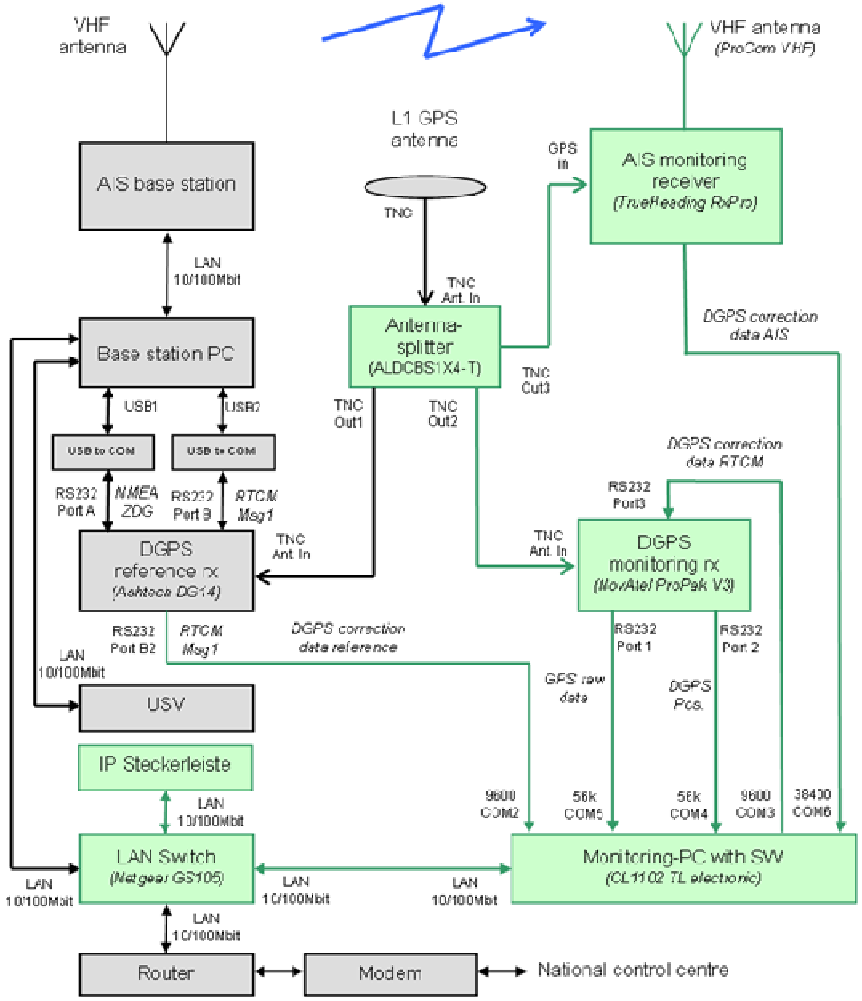
The necessary avail-Ability will be provided by Galileo + GPS.

Conclusion

- **In the near future NAVWAT will help to significantly reduce inland navigation disasters by the use of modern GNSS positioning technology making use of EGNOS and Galileo**

Further safety aspects

- **DoRIS AIS and IALA DGNSS integrity monitoring**
  - **Monitoring of DGNSS systems along the river Danube in Austria by a cost efficient SW based system**
  - **Easy integration in existing DGNSS stations**



NAVWAT

Future high precision navigation system for inland waterways

Philipp Berglez
Managing Partner & CTO

TeleConsult Austria GmbH
Schwarzbauerweg 3,
A-8043 Graz, Austria

pberglez@teleconsult-austria.at
www.teleconsult-austria.at
Phone: +43-316-890971-14