



# EGNOS for River Information Services

UN International Meeting on the Use and Applications of GNSS

Vienna, 15<sup>th</sup> of December 2004

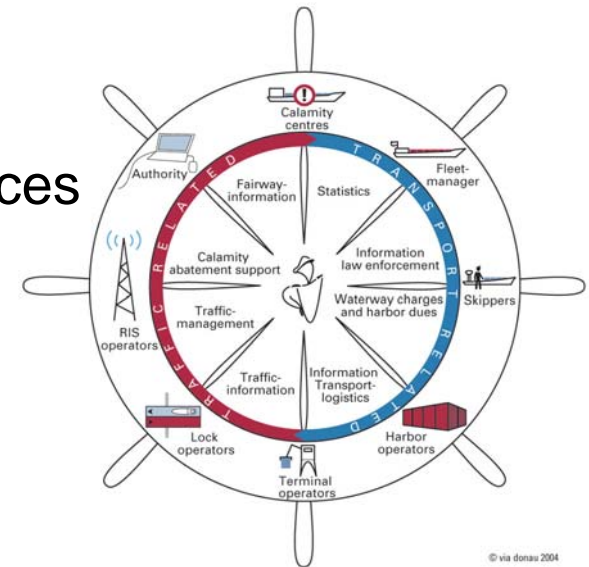
Seatex as a part of the Kongsberg Group

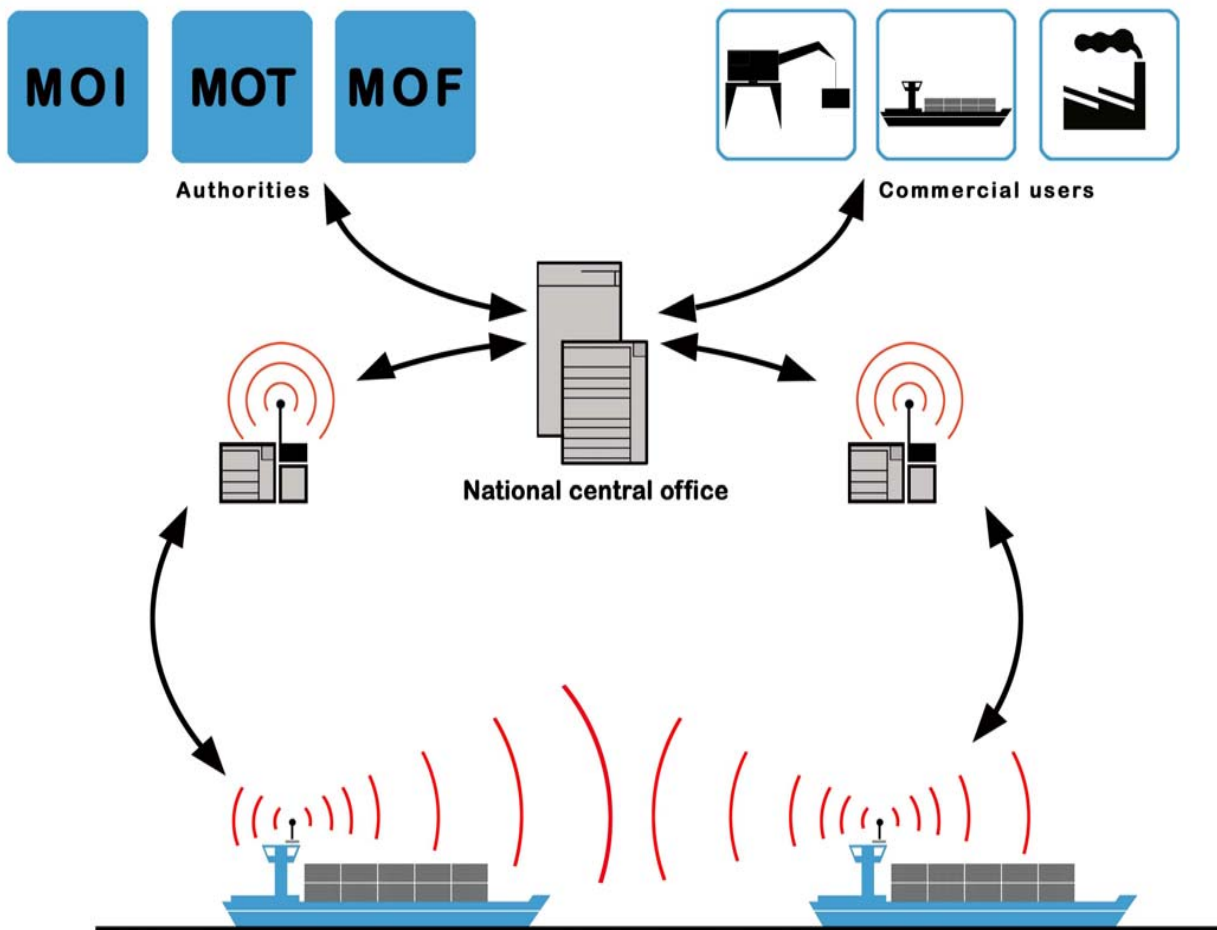


KONGSBERG



- Fairway Information Services
  - Electronic navigational charts and its updates
  - Notices to Skippers
- Traffic Information Services
  - Tactical Traffic Information
  - Strategic Traffic Information Services
- Traffic Management
  - Lock and Bridge Management
- Calamity Abatement Support
- Information to Enforcement
  - TTI to immigration authority
  - Immigration and Customs Control Service
- Transport Management
  - TTI to terminals and fleet operators





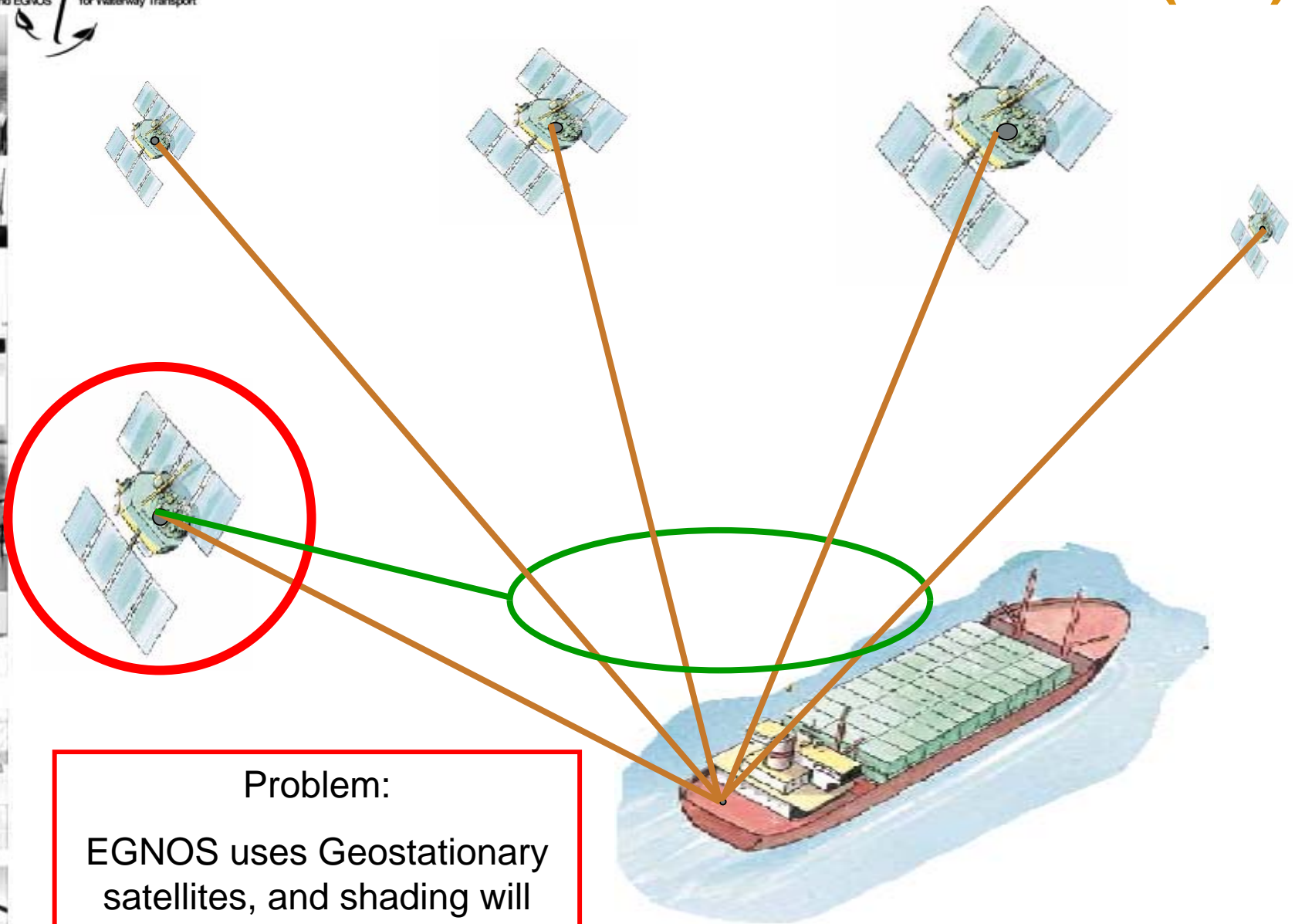
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- Increase safety of Waterway Transport
- Evaluation of the possible benefits of EGNOS and GALILEO in RIS
- Development of concepts Seamless integration of GALILEO and EGNOS in future RIS installations

GPS: Global Positioning System

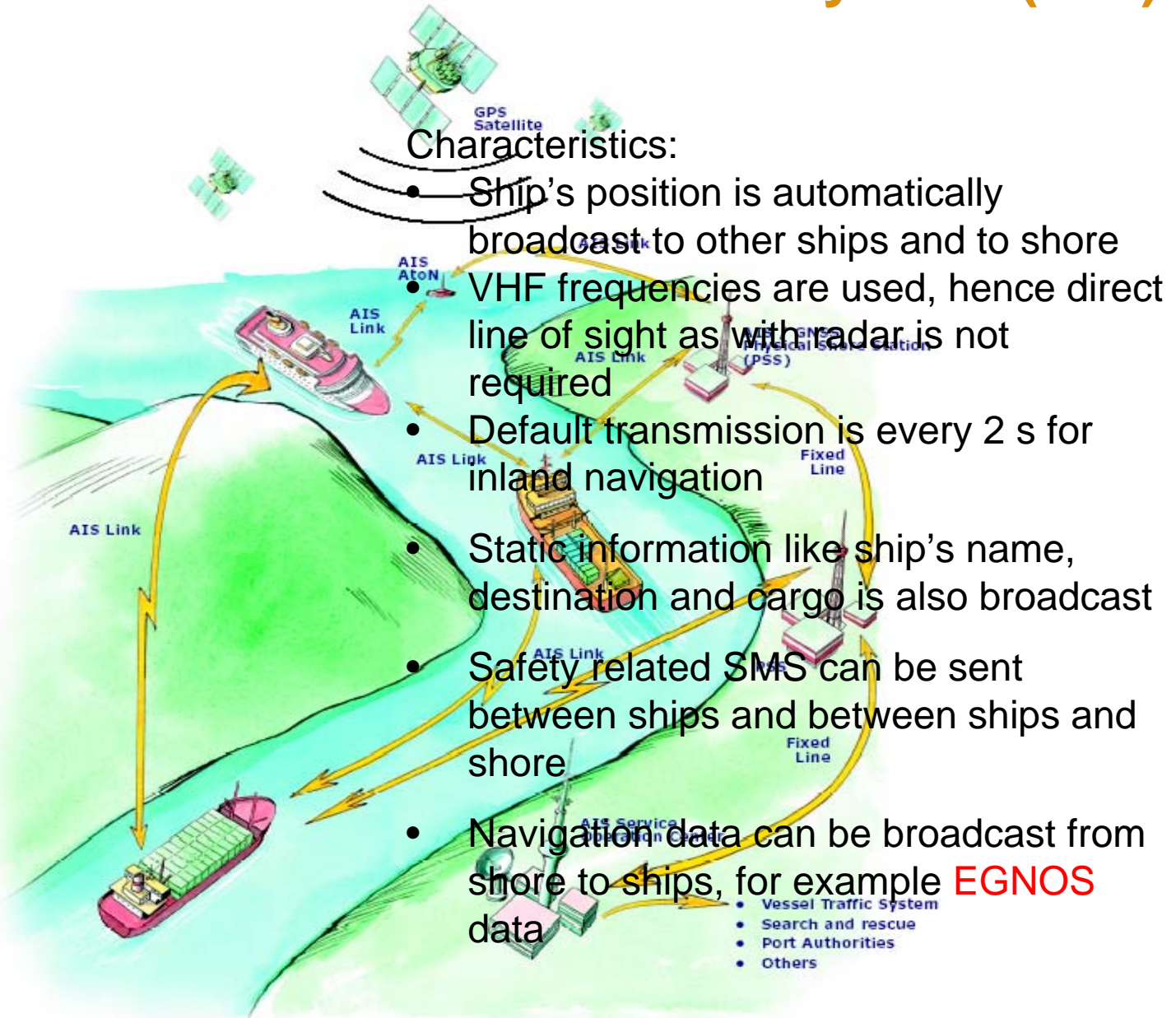
EGNOS: European Geostationary Navigation Overlay Service

- EGNOS provides enhancement of GPS to make the navigation service more accurate and reliable
- EGNOS is transmitted from geostationary satellites



**Problem:**  
EGNOS uses Geostationary satellites, and shading will occur at some points

# Automatic Identification System (AIS)

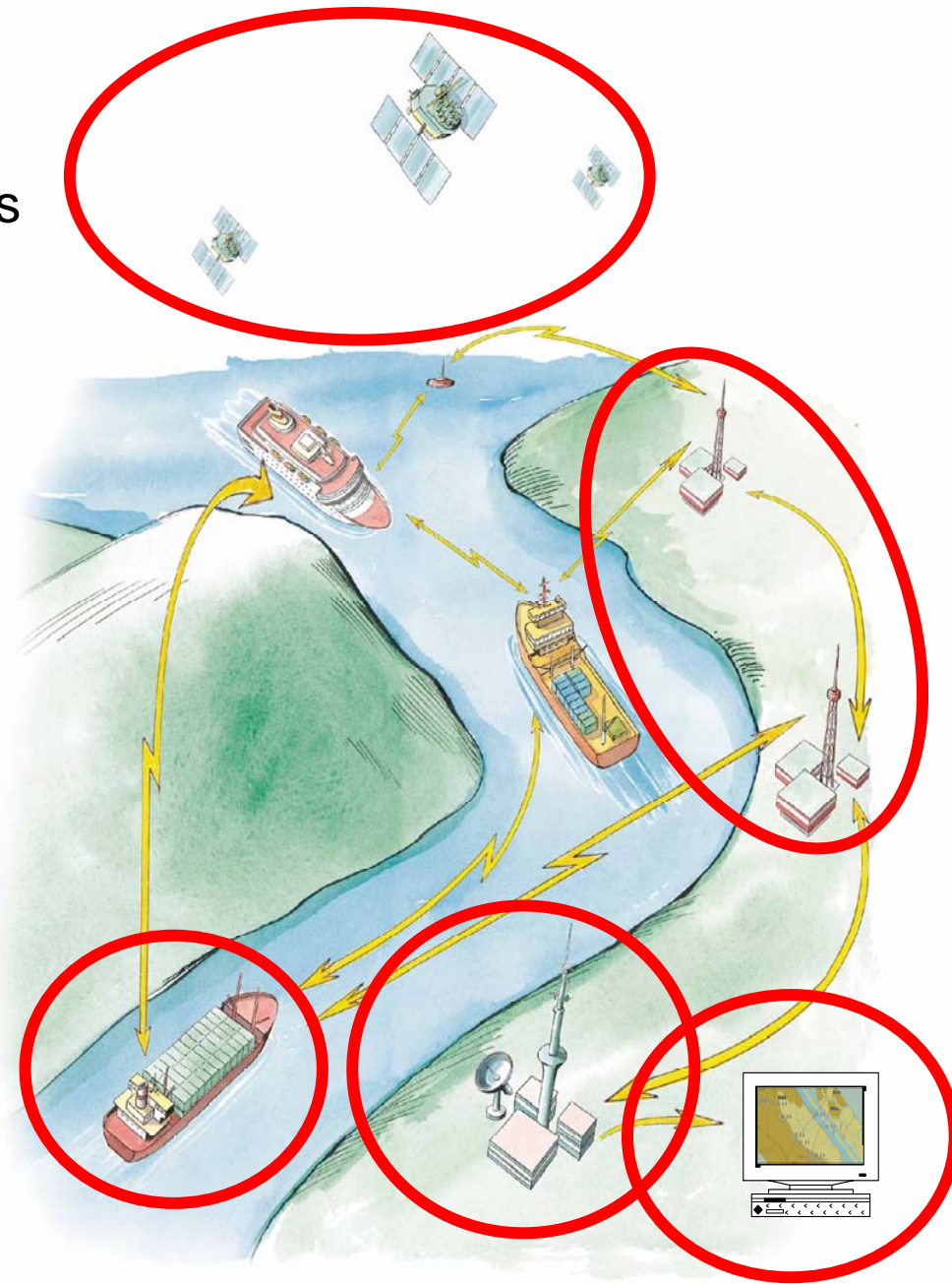


## Characteristics:

- Ship's position is automatically broadcast to other ships and to shore
- VHF frequencies are used, hence direct line of sight as with radar is not required
- Default transmission is every 2 s for inland navigation
- Static information like ship's name, destination and cargo is also broadcast
- Safety related SMS can be sent between ships and between ships and shore
- Navigation data can be broadcast from shore to ships, for example **EGNOS** data
  - Vessel Traffic System
  - Search and rescue
  - Port Authorities
  - Others

The Galewat System consists of following elements

- Ship Segment
- Shore Segment
- Regional Segment
- External Segment
- GPS and EGNOS satellites, and in the future, Galileo





Galewat aims at providing redundant EGNOS information:

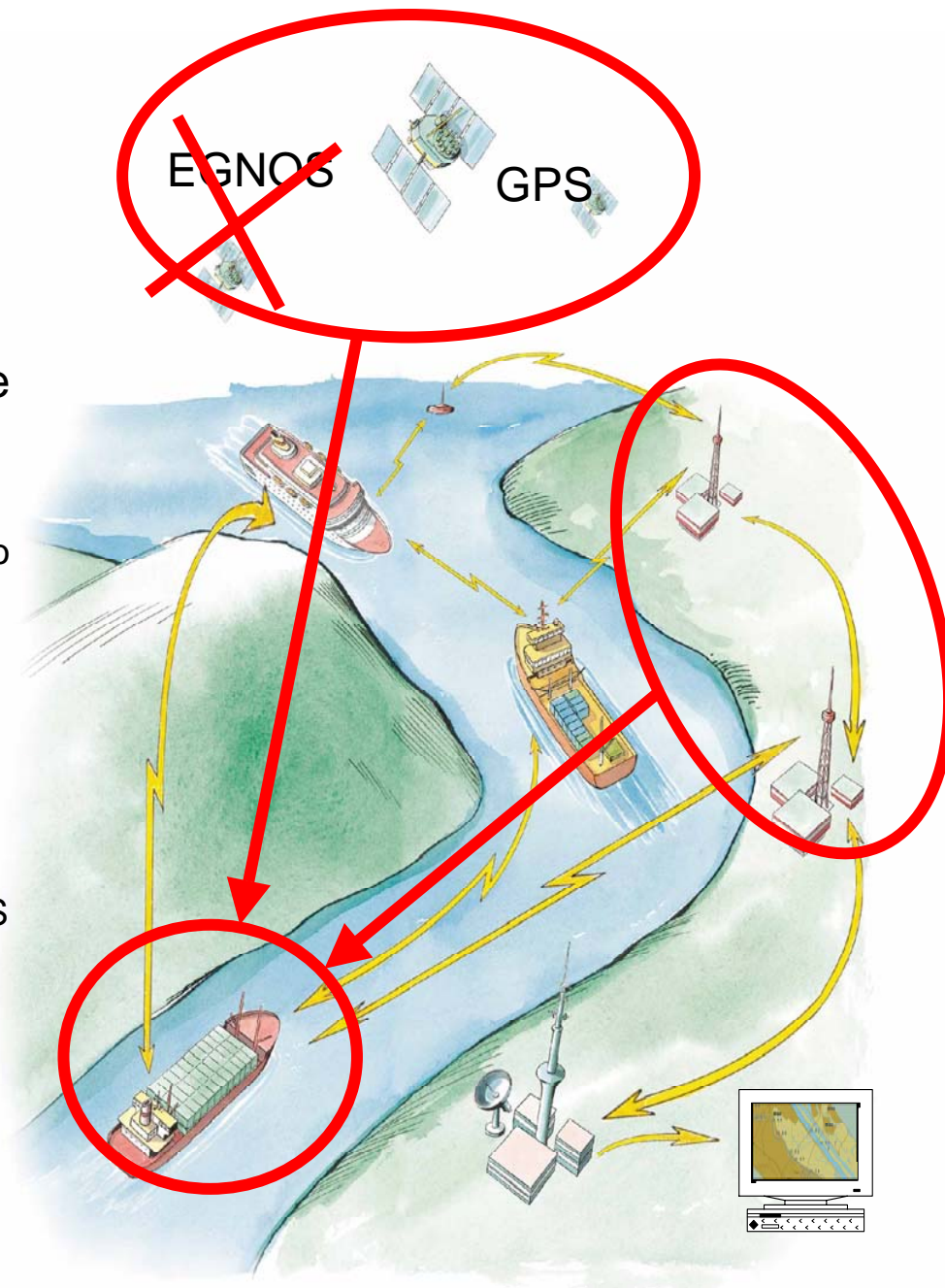
- The Ship receives GPS and EGNOS signals directly from the satellites.

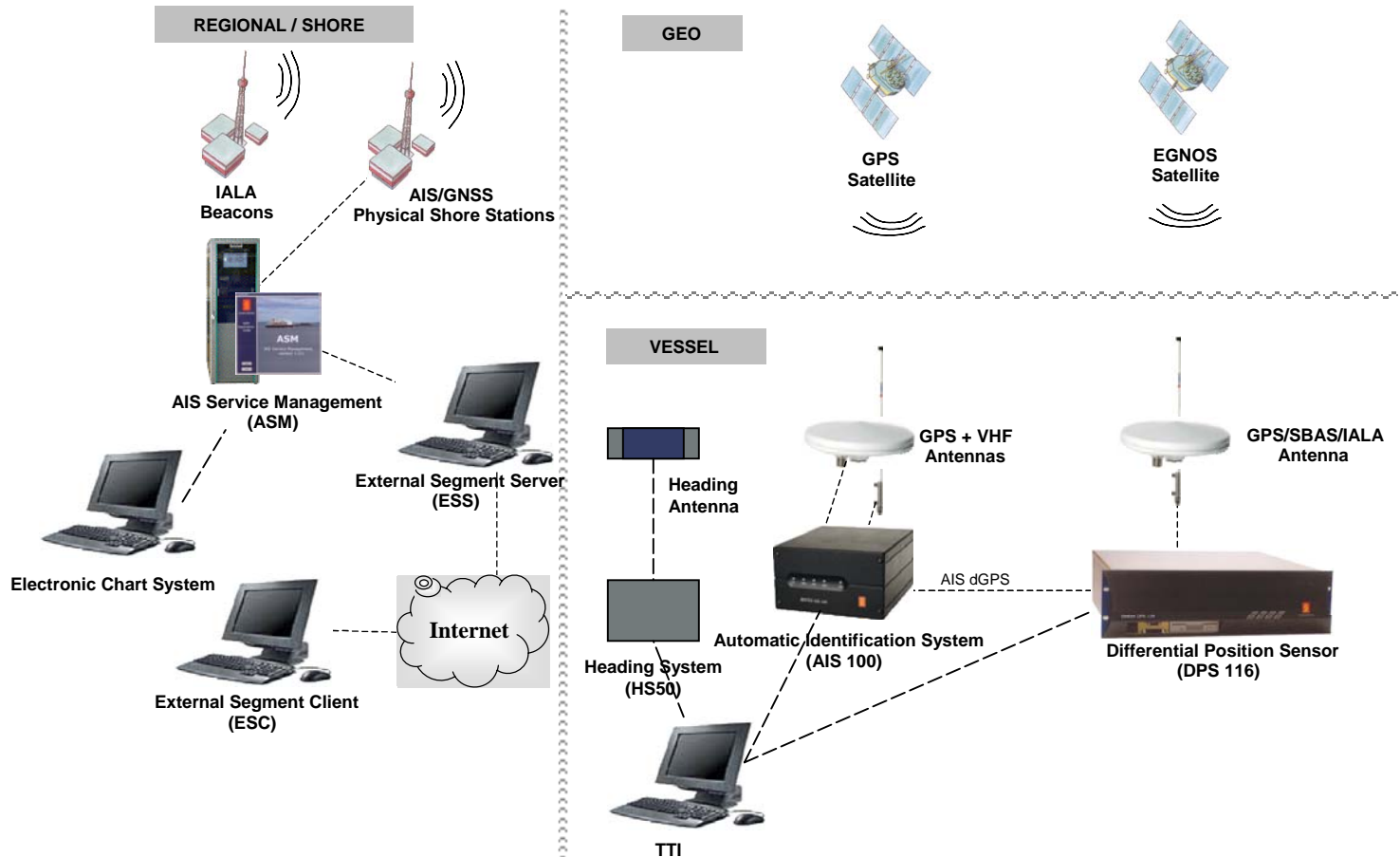
=> Improved accuracy and reliability (integrity) of position fix as compared to standalone GPS

- In case of shading of the EGNOS satellites, the Ship receives the EGNOS data from AIS Shore Station via Msg 17.

=> Improved availability as the EGNOS benefits are also available when EGNOS is shaded

=> The problem posted earlier is solved

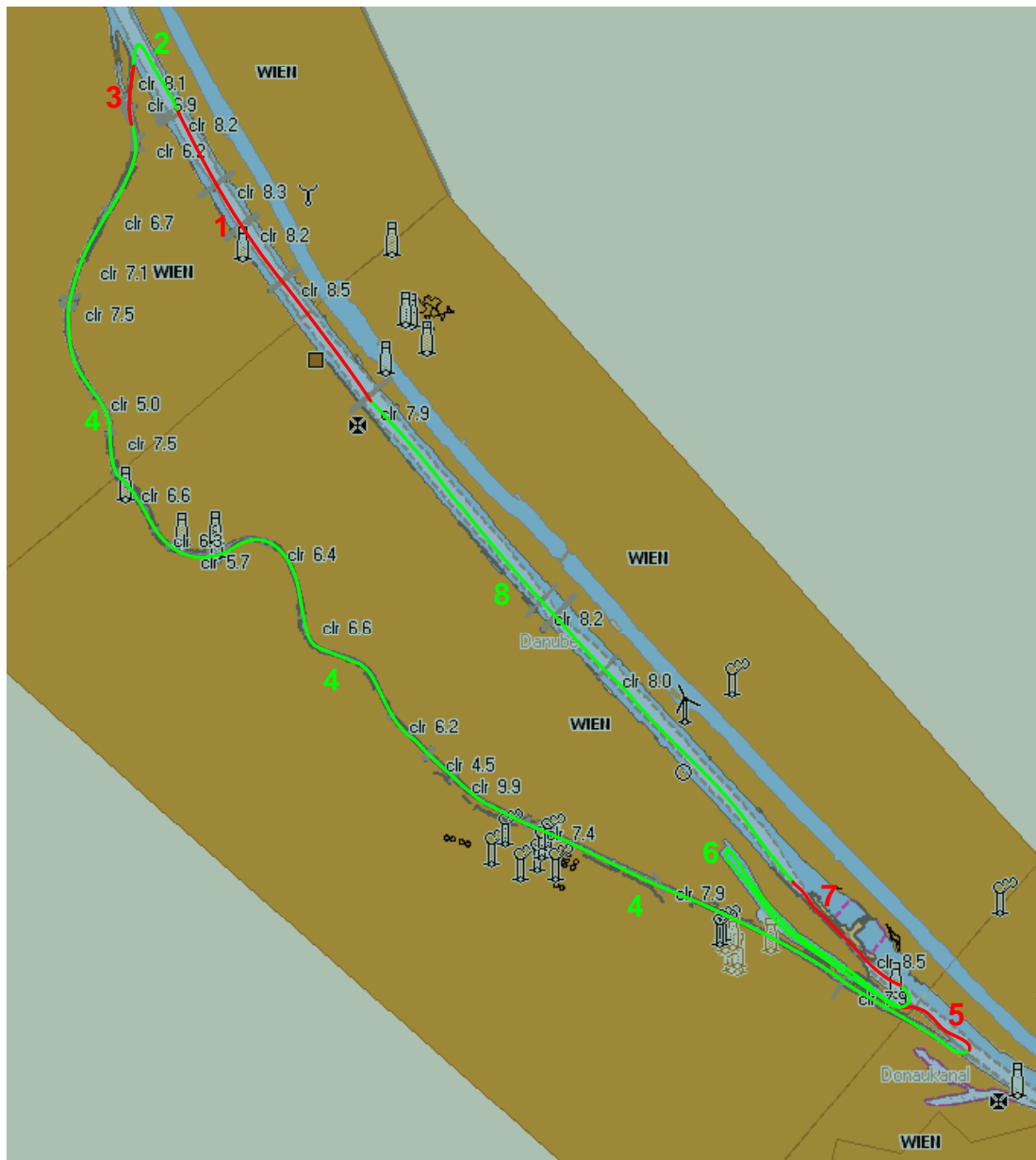




# Measurement Planning - Aims

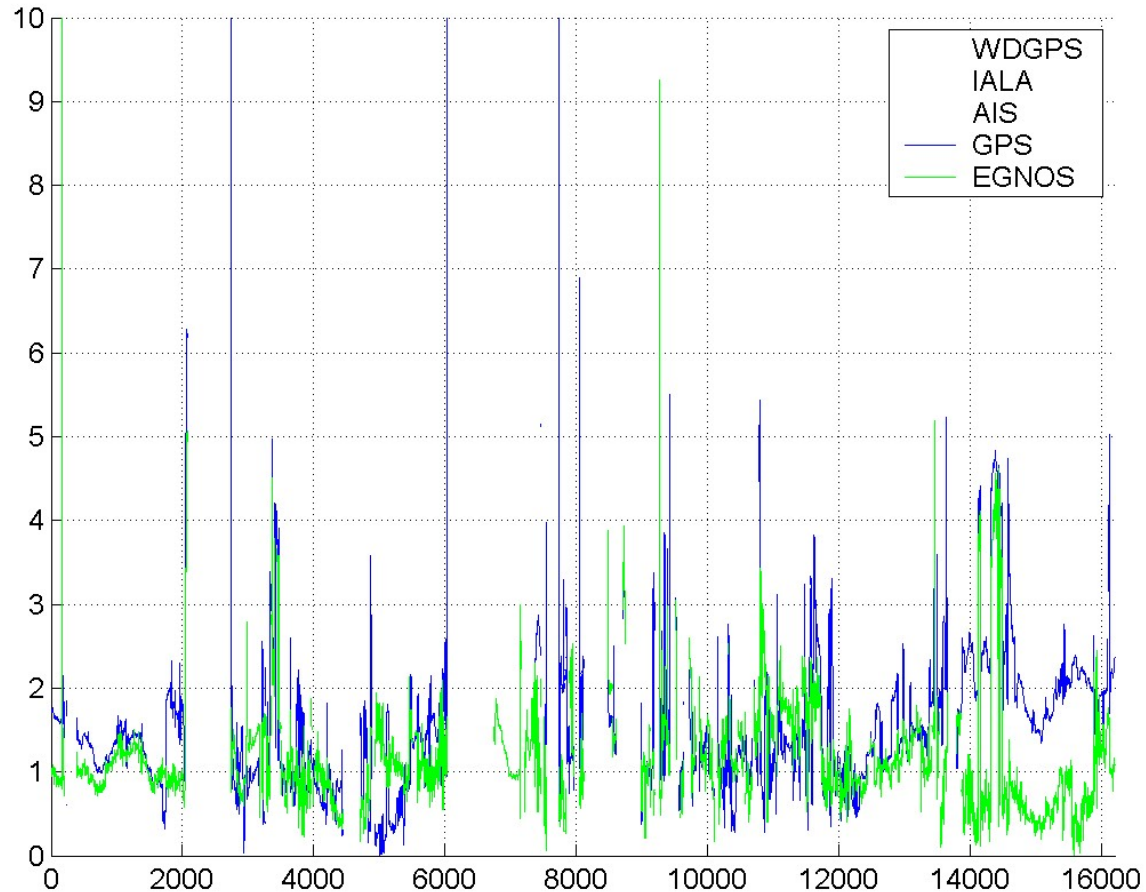
- Major aim of measurement campaign: Compare performance of:
  - GPS (stand alone)
  - EGNOS (from direct SiS)
  - EGNOS (broadcast over AIS)
  - IALA
  - Weighted DGPS (weighted mean of above solutions)
- Study usability of advanced AIS systems on inland waterways
- Evaluate advantages of a GALEWAT-like system compared to standard AIS systems

# Measurement Planning – Vienna Route



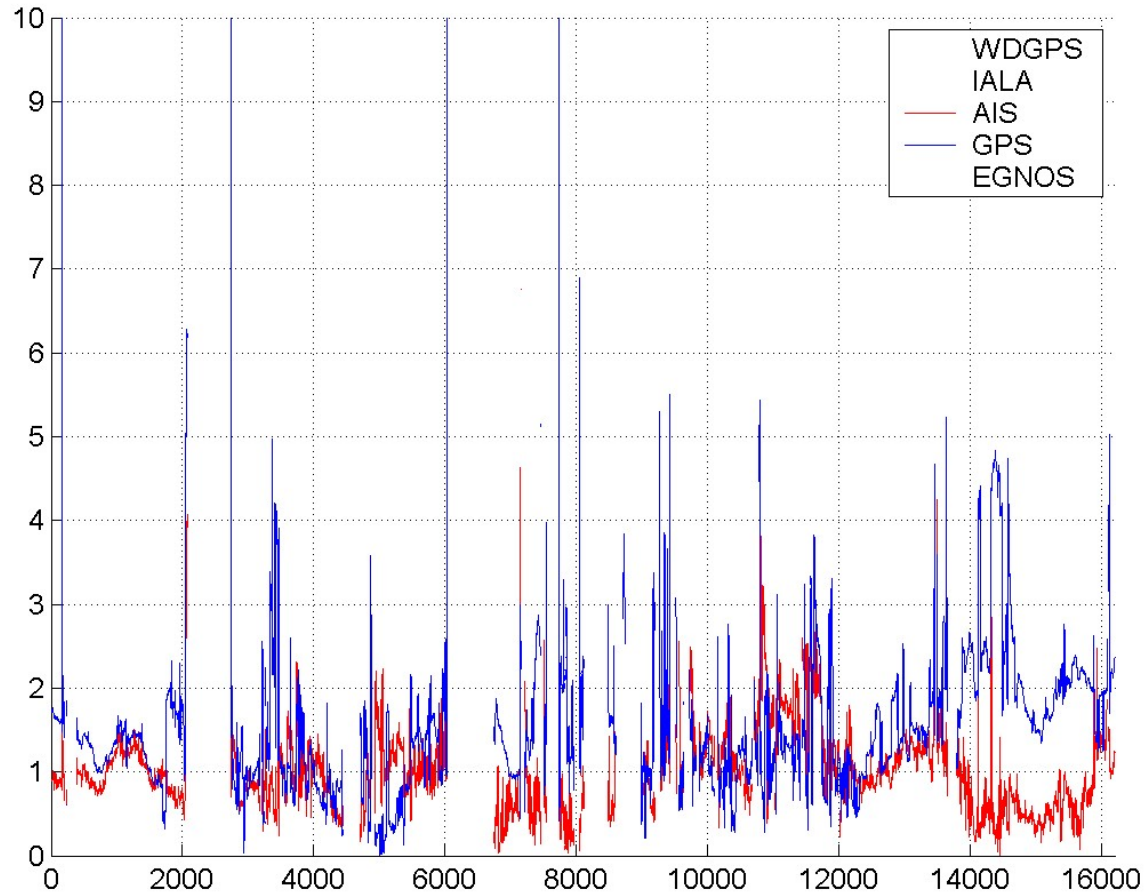
# Measurement Results (1)

Kinematic position accuracy: GPS and GPS/EGNOS compared to reference



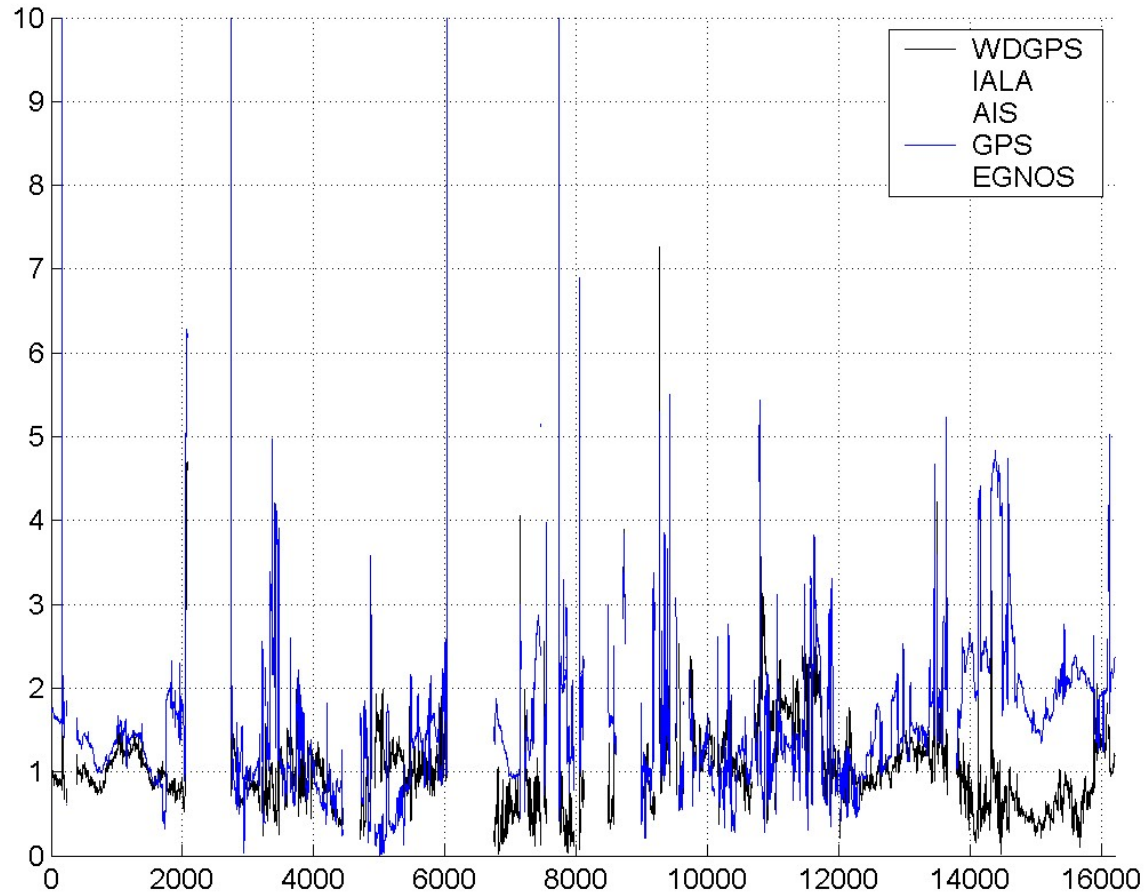
# Measurement Results (2)

Kinematic position accuracy: GPS and GPS/AIS compared to reference



# Measurement Results (3)

Kinematic position accuracy: GPS and WDGPS compared to reference



# Measurement Results (4)

## Availability of position

	REF	GPS	EGNOS	AIS	WDGPS
Total epochs observed	16201				
Availability (%)	79.91	89.80	86.13	88.85	90.18

## Accuracy of position

Confidence level (%)	GPS	EGNOS	AIS	WDGPS
63%	2,97	2,23	1,82	1,95
95%	4,35	3,30	2,52	2,75
99.99%	6,81	5,19	3,75	4,16

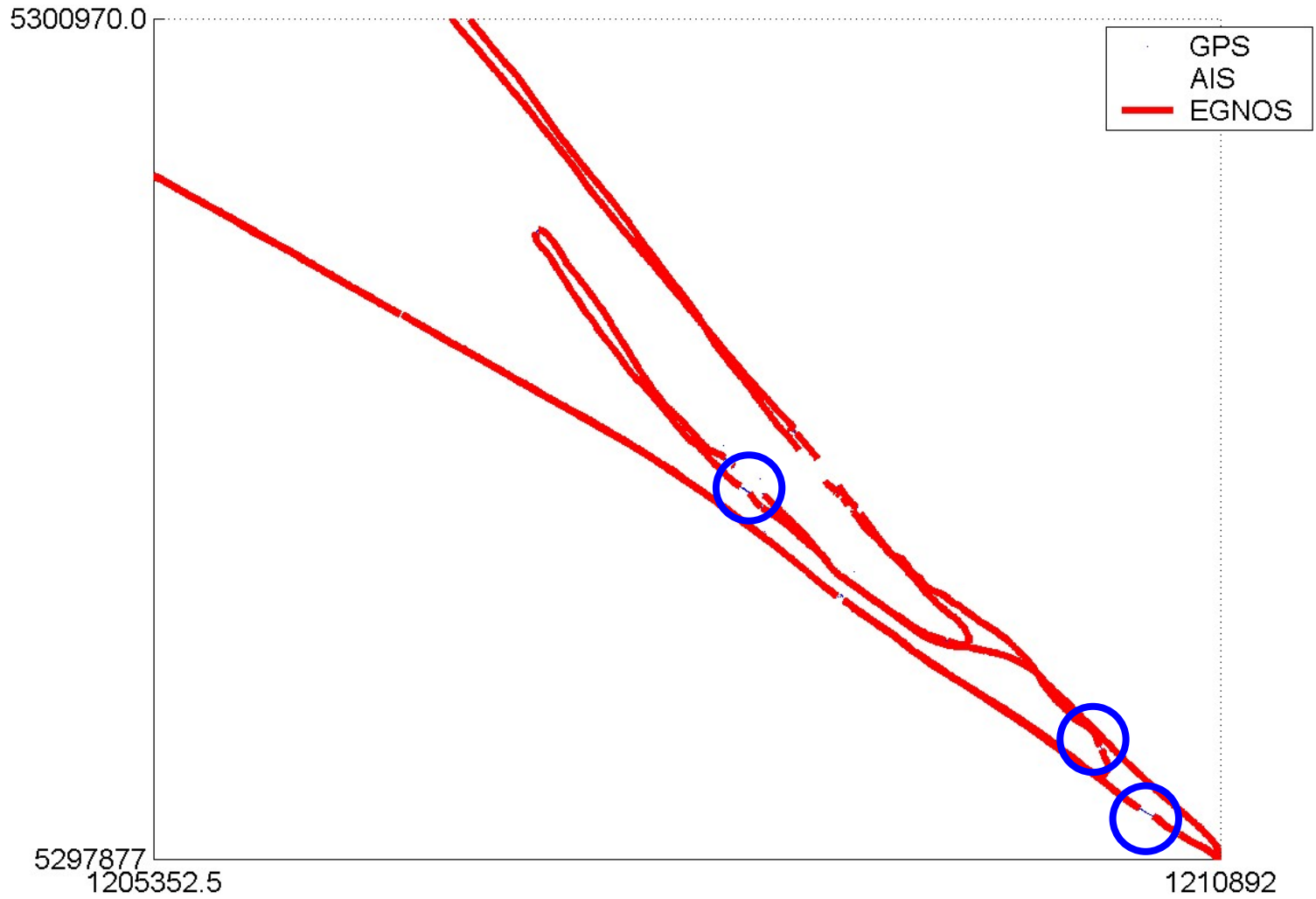


- EGNOS improves GPS accuracy
  - EGNOS provides additional ranging sources
  - EGNOS provides GPS integrity
- 
- EGNOS needs line-of-sight between GEOs and receiver
  - EGNOS data messages can be re-transmitted over terrestrial radio networks

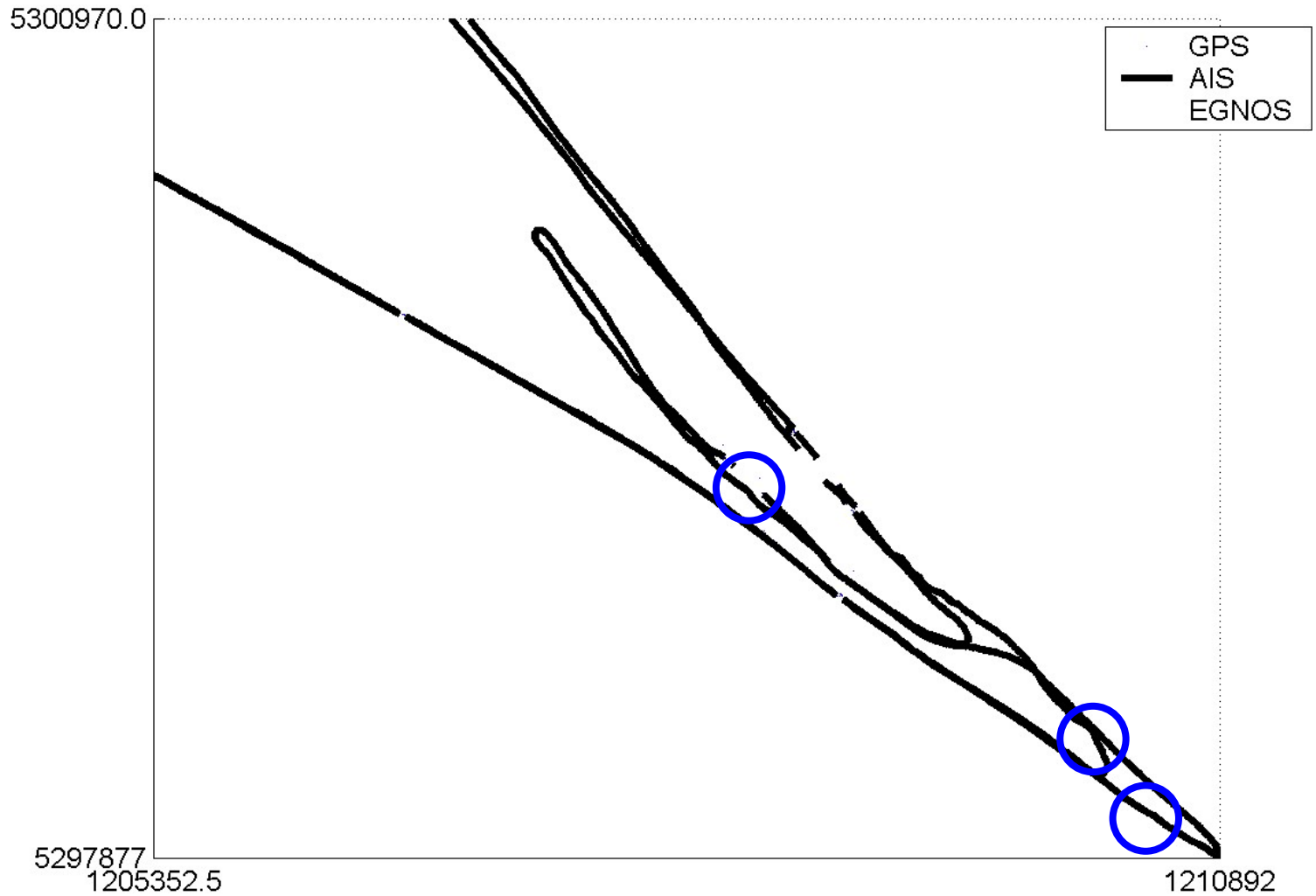
# Measurement Results (6)

	EGNOS	AIS
HPL < HAL (25 m)	99.80%	100%
HPL > Accuracy (empiric)	>99.99%	>99.99%

# Measurement Results (7)



# Measurement Results (8)



- For safety critical operations on inland waterways, there is a need for reliable position information
- EGNOS increases positioning accuracy of GPS
- EGNOS provides integrity to GPS
- EGNOS broadcast over AIS bridges outages of EGNOS SIS