EUPOS® - Developing a Full Scale Accuracy Ground Based Regional GNSS Infrastructure

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International EUPOS® Steering Committee

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• The EUPOS Initiative
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The *EUPOS* initiative

The International *EUPOS*® Steering Committee was founded with the aim to establish a uniform compatible, multifunctional DGNSS basis infrastructure for position determination, navigation and locating in interested countries of Central and Eastern Europe.

Berlin, March 5th, 2002
Bosnia and Herzegovina
Bulgaria
Czech Republic
Estonia
Hungary
Latvia
Lithuania
The Former Yugoslav Republic of Macedonia
Poland
Romania
Russian Federation
Serbia and Montenegro
Slovakia
Slovenia (observer status)
Ukraine
Berlin, Hamburg (consultative)
EUPOS® planning in Russia (partially realized)
**EUPOS®** planned and realized reference stations

<table>
<thead>
<tr>
<th>Country (ISO Country Code)</th>
<th>Area ([\text{km}^2])</th>
<th>Number of planned \textit{EUPOS®} reference stations</th>
<th>Number of realized \textit{EUPOS®} reference stations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EU member countries</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Czech Republic (CZ)</td>
<td>78,870</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td>Estonia (EE)</td>
<td>45,220</td>
<td>13</td>
<td>4(^5)</td>
</tr>
<tr>
<td>Hungary (HU)</td>
<td>93,030</td>
<td>36</td>
<td>17</td>
</tr>
<tr>
<td>Latvia (LV)</td>
<td>64,600</td>
<td>24</td>
<td>24(^6)</td>
</tr>
<tr>
<td>Lithuania (LT)</td>
<td>65,300</td>
<td>13</td>
<td>1(^7)</td>
</tr>
<tr>
<td>Poland (PL)</td>
<td>323,520</td>
<td>86</td>
<td>20 [86](^8)</td>
</tr>
<tr>
<td>Slovak Republic (SK)</td>
<td>49,035</td>
<td>21</td>
<td>2(^9) [21]</td>
</tr>
<tr>
<td>(observer) Slovenia (SI)</td>
<td>20,270</td>
<td>15</td>
<td>15(^10)</td>
</tr>
</tbody>
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<td><strong>EU candidate countries</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bulgaria (BG)</td>
<td>110,950</td>
<td>23</td>
<td>5</td>
</tr>
<tr>
<td>Romania (RO)</td>
<td>237,500</td>
<td>48</td>
<td>13</td>
</tr>
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<td><strong>West Balkan States</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bosnia and Herzegovina (BA)</td>
<td>51,000</td>
<td>30</td>
<td>30(^2)</td>
</tr>
<tr>
<td>Macedonia FYROM (MK)</td>
<td>25,330</td>
<td>15</td>
<td>1(^3)</td>
</tr>
<tr>
<td>Serbia and Montenegro (YU)</td>
<td>88,360</td>
<td>32</td>
<td>32</td>
</tr>
</tbody>
</table>

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<tr>
<td><strong>Russian Federation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Russian Federation (RU)</td>
<td>17,075,000</td>
<td>500 stations at all(^4)</td>
<td>31</td>
</tr>
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<td><strong>Ukraine</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ukraine (UA)</td>
<td>603,700</td>
<td>n/a(^5)</td>
<td>13</td>
</tr>
</tbody>
</table>

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1) In seven federal districts, will cover not the whole territory of the Russian Federation (cf. fig. 3)
2) The design of the Ukraine \textit{EUPOS} is not yet completed
3) Number of reference stations which exist and shall be updated to \textit{EUPOS} stations
4) Including the national State Land Service (19) and the Riga City (5) \textit{EUPOS} reference stations
5) The complete System will be established in 2006
6) The system is complete \textit{EUPOS} compatible

Topicality April 2006
The organizational structure of EUPOS

<table>
<thead>
<tr>
<th>International EUPOS® Steering Committee (ISC)</th>
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</thead>
<tbody>
<tr>
<td>Representatives of all EUPOS® member countries</td>
</tr>
<tr>
<td>Office (ISCO)</td>
</tr>
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</table>

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<tr>
<th>National EUPOS® Service Centers (NSCs)</th>
</tr>
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<tbody>
<tr>
<td>EUPOS® providers, if not the same</td>
</tr>
</tbody>
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<tr>
<th>Authorized EUPOS® resellers</th>
</tr>
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<tr>
<th>EUPOS® users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturers of EUPOS® compatible hardware/software</td>
</tr>
<tr>
<td>Resellers of EUPOS® compatible hardware/software</td>
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</table>

1) Working Group on Technical Cooperation with the Industry;
2) Working Group on System Quality, Integrity and Interference Monitoring
The National Service Centre (NSC) organisational structure

- **EUPOS® International Steering Committee and office, Berlin**
- **EUPOS® National Service Centres of the neighbouring countries**
- **National Authorities and Regulatory Bodies**
- **EUPOS® NATIONAL SERVICE CENTRE**
  - **EUPOS® Networking Stations**
  - **EUPOS® Integrity Monitoring Stations**
  - **EUPOS® Reference Stations**
- **Mobile service and interference monitoring team**
- **Real-time data providers (telecommunication companies and/or other representatives of the private sector)**

**EUPOS® user community:**
- Agriculture
- Mapping
- Environment protection
- Forestry
- GIS
- Security services
- Geodesy
- Telematics
- Traffic management
- Water resources management
- etc.

**Nodes:**
- International organisation
- National state organisation
- Private sector
- End users
**EUPOS cooperation and coordination with other international organizations**

Cooperation with the UN Office for Outer Space Affairs, UN OOSA supports *EUPOS*

GALILEO Joint Undertaking accepted the necessity of reference station systems and welcomes *EUPOS*, an information exchange is agreed

The promotion of the operation *EUPOS*-IRC in 2006 et sqq. by EU INTERREG III C East/INTERREG IV programmes is expected

Official participation of representatives of both EUREF TWG and *EUPOS* ISC respectively in the other organization conferences

*EUPOS* is member of the International Committee on GNSS (ICG)

*EUPOS* is member of the US Radio Technical Commission for Maritime Services (RTCM)
Some Technical Characteristics of EUPOS

- Unified world-wide unlimited and gratis usable Standards, guaranteed downward-compatibility in the case of further development
- Equal opportunities for companies, investment safety for all economy enterprises, EUPOS providers and EUPOS users
- Use of GALILEO (duty if competely available), NAVSTAR-GPS (optional), GLONASS (optional)
- Guaranteed EUPOS availability of 99% at minimum (99.8%)
- Standard medium Internet for all Services
- Optional additional media radio, public broadcast, TV broadcast etc. for the EUPOS real-time sub-services
EUPOS - Sub-Services

- **EUPOS DGNSS** – real-time service, reachable precision dependent on the user equipment
  0,5 m - 2 m for moved objects,
  0,2 m - 1 m for stationary positioning

- **EUPOS Network RTK** – real-time service, 2 cm accuracy

- **EUPOS Geodetic, post processing service**, ca. 1 cm precision by short observations and using near real-time procedures
  sub-centimeter precision with long lasting observations, using precise ephemerides etc.
Examples of **EUPOS®/SAPOS®** applications
Vehicle Scheduling and Control System of the Berliner Verkehrsbetriebe (BVG)

- punctuality, connection quality
- dynamic passenger information
- influence of traffic lights
- acceleration measurements

- flexible change of routes
- safety for passengers, drivers
- reduced costs
Central Police Traffic Service of Berlin (ZVkJD)

State visitors, demonstrations, parades etc.

- Escorting of important state visitors
- Flexible changes of routes
- Precise traffic steering in time
- Security measurements
Autonomous fleet management and guiding system
Management of freight vehicles on large building sites

Rhenus Baulogistik GmbH
www.rhenus.de
Risk tracking – EU project VIKING
Lane-precise Floating Car Data in real time for traffic steering measurements
EU project Mobility for Blind and Elder People interaction with Computer

MoBIC
Meyer Werft Papenburg

Transfer of ocean liners after production at the river Ems into the deep fair-way of the North Sea
Dynamic passenger information system and precise positioning and navigation

HADAG
Hafen-Dampfschifffahrt-Aktiengesellschaft
Hamburg
Dynamic passenger information system and precise positioning and navigation

Special missions, e.g.

- rescue helicopters (tested)
- safeguarding tasks (tested)
- measurements for radio/TV broadcast supply (field strength)

Precise starting and landing (tested)
Dynamic surveying of roadway – inclusion of traffic relevant data (e.g. road signs, possibilities to turn)
Geo-information, surveying, geodesy
Weather-forecast and climate research
Agriculture

area determination, yield cartography, specific partial acre farming management

Environmental protection and reduced costs by

- reduction of sprinkled herbicide,
- specific deploying of agriculture operating supplies
Conclusion

GNSS and DGNSS technology and applications move forward as well as the establishment of space- and ground-based GNSS augmentation systems.

Fundamental GNSS-based reference frameworks approach at real-time data provisions.

Compatibility and interoperability are highly important for economic reasons and to strengthen the benefits.

Both AFREF and **EUPOS** are international initiatives which were identified priority projects for support by the UN OOSA.

If AFREF (e.g. partly) think about the provision of DGNSS real-time data in the future a cooperation with **EUPOS** for interoperability and compatibility offers a great chance to increase lasting the benefits of both systems.
Thank you very much for your attention!