European Position Determination System Status and Activities

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\(c/o\) Senate Department for Urban Development, State of Berlin, Germany

Third Meeting of the International Committee on Global Navigation Satellite Systems
Pasadena, U.S.A.
8-12 December 2008
Third Meeting of the International Committee on Global Navigation Satellite Systems

EUPoS members
Bosnia and Herzegovina
Bulgaria
Czech Republic
Berlin (ISCO)
Estonia
Hungary
Kazakhstan (invited guest)
Latvia
Lithuania
Macedonia
Moldova
Poland
Romania
Russian Federation
Serbia
Slovakia
Slovenia (observer)
Turkey (invited guest)
Ukraine

Legend
- **EUPoS** member
- **EUPoS** observer
- **EUPoS** guest
- **EUPoS** others
## Status of the EUPOS reference station infrastructure as at 14 November 2008

<table>
<thead>
<tr>
<th>Country</th>
<th>Area (km²)</th>
<th>planned RS</th>
<th>realised RS</th>
<th>Country</th>
<th>Area (km²)</th>
<th>planned RS</th>
<th>realised RS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA</td>
<td>51,000</td>
<td>26</td>
<td>0(^2)</td>
<td>MK</td>
<td>25,434</td>
<td>14</td>
<td>9</td>
</tr>
<tr>
<td>BG</td>
<td>110,950</td>
<td>23</td>
<td>12</td>
<td>MD</td>
<td>33,700</td>
<td>currently not def.</td>
<td></td>
</tr>
<tr>
<td>CZ</td>
<td>78,870</td>
<td>27</td>
<td>27</td>
<td>PL</td>
<td>323,520</td>
<td>98</td>
<td>98</td>
</tr>
<tr>
<td>Berlin/DE</td>
<td>891</td>
<td>4</td>
<td>4</td>
<td>RO</td>
<td>237,500</td>
<td>73</td>
<td>58</td>
</tr>
<tr>
<td>EE</td>
<td>45,220</td>
<td>17</td>
<td>9</td>
<td>RU</td>
<td>17,075,400</td>
<td>not def.</td>
<td>&gt;100</td>
</tr>
<tr>
<td>HU</td>
<td>93,030</td>
<td>36</td>
<td>34</td>
<td>RS</td>
<td>88,360</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td>LV</td>
<td>64,600</td>
<td>19</td>
<td>19</td>
<td>SK</td>
<td>40,035</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>Riga/LV</td>
<td>307</td>
<td>5</td>
<td>5</td>
<td>Ukraine</td>
<td>603,700</td>
<td>27(^3)</td>
<td>5</td>
</tr>
<tr>
<td>LT</td>
<td>65,300</td>
<td>25</td>
<td>25</td>
<td>SI (obs.)</td>
<td>20,270</td>
<td>15</td>
<td>15</td>
</tr>
</tbody>
</table>

\(^1\) ISO 3166 Codes (Countries), \(^2\) realisation in 2009, \(^3\) by 2012
**EUPOS Technical Specifications**

Unified international accepted standards and guaranteed downward compatibility when future developments.

Thus enables equal opportunities for business enterprises and investment protection for all EUPOS providers, users and enterprises.

Official geodetic terrestrial reference system for EUPOS is the European Terrestrial Reference System 1989 (ETRS 89) and its actual frame.

Use of Galileo (when operable), GPS and GLONASS recommended and Compass when operable.

Minimum availability of EUPOS is 99% p.a.

Basic standard medium for all services is mobile Internet, e.g. provided via GPRS, UMTS, HSDPA, WLAN, etc.

Broadcast as optional standard via media such as VHF, radio broadcast, TV broadcast, and when available Internet User Datagram Protocol (UDP) multicast, etc.
**EUPOS Sub-Services**

**EUPOS** DGNSS for real-time DGNSS applications by code and code-phase measurements with accuracy of 2 m up to 0.5 m for dynamic applications, and up to 20 cm for static applications, depending on the applied rover equipment; DGNSS corrections are in standard data format RTCM SC-104.

**EUPOS** Network RTK for real-time DGNSS applications by carrier phase measurements with an accuracy of determination with an accuracy $\leq 2$ cm (1σ, horizontally). **EUPOS** strives to provide DGNSS correction data that support all existing network RTK solutions (FKP, non-physical reference station and MAC).

**EUPOS** Geodetic for post-processing applications by code and phase measurements in static or kinematics mode with decimetre up to sub-centimetre accuracy. User interfaces are GNSS observation data in RINEX 3.0, also for the third GPS frequency L5 and Galileo. It is recommended for a limited period to provide both data formats RINEX 2.11 and 3.0.
## The organisational structure of EUPOS

<table>
<thead>
<tr>
<th>International EUPOS Steering Committee (ISC)</th>
<th>Office of the ISC (ISCO)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Representatives of the EUPOS member countries</td>
<td>EUPOS working groups</td>
</tr>
<tr>
<td>National EUPOS Service Centres (NSCs)</td>
<td>EPOS providers (if EUPOS is not operated by the NSCs)</td>
</tr>
<tr>
<td>EUPOS providers (if EUPOS is not operated by the NSCs)</td>
<td></td>
</tr>
<tr>
<td>Technical Cooperation with the Industry (TCI)</td>
<td>System Quality, Integrity and Interference Monitoring (SQII)</td>
</tr>
</tbody>
</table>

**Authorized EUPOS resellers**

**EUPOS users**

**Manufacturers of EUPOS compatible hardware/software**

**Resellers of EUPOS compatible hardware/software**
Third Meeting of the International Committee on Global Navigation Satellite Systems

**EUPROS National Service Centres structure**

- **International EUPROS® Steering Committee (ISC)**
  - INTERREG III C EUPROS®-IRC Steering Committee working groups, Regional Policy Board

- **neighbouring countries’ National EUPROS® Service Centres**

- **National EUPROS® Service Centre**
  - **EUPROS®-IRC Know-how Office**
  - **maintenance and interference monitoring team**
  - **networking centre**
  - **real-time data providers**
    - private investors, application developers
  - **integrity monitoring stations**
  - **GNSS reference stations**

- **EUPROS® user community:**
  - surveying, geodesy
  - agriculture
  - mapping
  - disaster management
  - environmental protection
  - forestry
  - GIS
  - security services
  - telematics
  - traffic management
  - water resources management
  - etc.

- **external experts**
  - (e.g. from universities, research groups etc.)

- **national authorities and regulatory bodies**
  - (e.g. ministries, telecom. authority, etc.)

Legend:
- International organisation
- public sector
- private sector
- end users

Gerd Rosenthal
Office of the International EUPROS® Steering Committee, Berlin, Germany

Pasadena CA, U.S.A., 8 – 12 December 2008
**EUPOS’ cooperation with other organisations**

Cooperation with the United Nations Office for Outer Space Affairs. **EUPOS** is associated member of the International Committee on GNSS. GALILEO Joint Undertaking accepted the necessity of ground-based GNSS augmentation systems and welcomed **EUPOS**.

**EUPOS** initiates cooperation of sub-Saharan African countries and GNSS enterprises under patronage of the UN/ICG to establish “full scale accuracy” ground-based DGNSS.

Official participation of representatives both EUREF TWG and **EUPOS** ISC in the other organisation’s conferences.

**EUPOS** is member of the Radio Technical Commission for Maritime Services (RTCM).
Selected EUPOS activities

Work for the completion of the EUPOS infrastructure
Further building up and improvement of reference stations and networking centres;
Continueing absolute PCV calibration of all EUPOS reference stations antennas

Technical matters
EUPOS contributes to the Radio Technical Commission for Maritime Services (RTCM), e.g:
Development of Private Service Messages (RTCM data encryption) that should become RTCM standard in 1st quarter of 2009;
Development of real time quality information messages for DGNSS/RTK users will be proposed at the next RTCM SC 104 meeting, February 2009

Development of a self-certification procedure corresponding with the EUPOS technical standards, including measurements on the spot and ToR;
Collaboration on examination of multipath influences especially at GNSS reference stations
Selected EUPOS activities

Administrative matters
Establishment of National/Regional Service Centres in every EUPOS country;
Establishment of a common EUPOS data processing centre;
Information provision by the means of national and international brochures, newsletters, EUPOS member websites, information days;
Study visits for application demonstrations;
Transfer of applications to other countries and regions;
Cooperation with other infrastructures, organisations and projects.

Contributing to the UN/ICG goals and work
E.g. draft definition of interoperability applicable to ground-based differential GNSS (DGNSS) networks in cooperation with IGS etc.;
(Non financially) support of DGNSS “full scale accuracy” Demonstration projects in sub-Saharan Africa in cooperation with the industry;
UN/ICG/EUPOS/Berlin Symposium on GNSS, DGNSS and applications.
Actual documents of the EUPOS-ISC

**EUPOS Terms of Reference**
20 September 2007, updated on 23 April 2008

**EUPOS Technical Standards**
complete revised second edition, 24 April 2008

**EUPOS Guidelines for Single Site Design**
Version 2.1, 4 June 2008

**EUPOS Guidelines for EUPOS Reference Frame Fixing**
Version 1.0, 21 September 2007

**EUPOS Guidelines for Cross-Border Data Exchange**
Version 1.0, 21 September 2006

http://www.eupos.org/index.php?option=com_content&task=view&id=43&Itemid=91
International Symposium on Global Navigation Satellite Systems, Space-Based and Ground-Based Augmentation Systems and Applications

Berlin, Germany
11-14 November 2008
International Symposium on Global Navigation Satellite Systems, Space-Based and Ground-Based Augmentation Systems and Applications

Ca. 200 participants of GNSS providers, DGNSS infrastructures, users and industry from 28 countries and four continents,

36 lectures about GNSS, global ground-based services and analyses, regional reference systems, quality assurance and DGNSS/RTK improvement, public and private services and activities, applications and companies’ developments

Eight excursions to EUPOS/SAPOS reference station system centre and absolute GNSS antenna calibration robot, and DGNSS users: Berlin public transport company (BVG) central control office for bus transport system, Berlin fishering administration ship demonstration and German waterway and shipping administration, Berlin. One bus tour Urban on development of the centre of Berlin
Recommendation 1

Recognising the present status of Global Navigation Satellite Systems (GNSS) and the prospects for continued development of a wide variety of applications critical to science, commerce, and infrastructure, the Symposium participants recommend:

The continuation of forums such as this one; bringing together system providers, geodetic infrastructure providers, end users, and industry.

Furthermore, these forums should be encouraged to discuss and propose specific recommendations for consideration by the International Committee on GNSS (ICG)

Recommendation 2

Recognising the densification of the ground-based GNSS infrastructure by the EUPOS initiative on the basis of IAG services and Sub-Commissions,

considering the varied degree of GNSS ground-based reference infrastructure development among different regions of the world,

noting the need to support the effort of African countries to implement a continental geodetic reference frame,

the Symposium participants recommend that the ICG support the development of GNSS ground-based infrastructure in all regions of the world, taking into account the unique conditions present in each region and the need for tailored approaches to implementation.
Observation

The Symposium participants took note of the establishment of the network of EUPOS national and regional service centres located at:

**Czech Republic**
CZEPOS
Lands Survey Office
Geodetic Control Section
Pod sídlištěm 9/1800, CZ-18211-Prague 8
phone: +420 284 041 533
phone: +420 284 041 536
fax: +420 284 041 625
czepos@cuzk.cz
http://czepos.cuzk.cz/

**Estonia**
ESTPOS
Estonian Land Board
Mustamäe tee 51, EE-10621 Tallinn
phone: +37 26 65 06 00
fax: +37 26 65 06 04
maaamet@maaamet.ee
http://www.maaamet.ee/

**Berlin-Germany**
SAPOS/EUPOS
Senate Department of Urban Development
Fehrbelliner Platz 1
phone: + 49 171 22 27 019, +49 30 9012 7474
fax: +49 30 9012 3709
sapos.infos@senstadt.berlin.de
http://www.stadtentwicklung.berlin.de/geoinformation/landesvermessung/
www.eupos.org

**Hungary**
GNSSNET.HU
Institute of Geodesy, Cartography and Remote Sensing
Satellite Geodetic Observatory
P.O. Box 585, HU-1592 Budapest
phone: +36 27 374 980
fax: +36 27 374 982
support@gnssnet.hu
http://www.gnssnet.hu/
Latvia
LAPOS
Latvia Positioning Service
43 O. Vaciesa street
LV-1004 Riga
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fax: +37 16 706 4209
http://latpos.lgia.gov.lv/

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EUPOS-Riga
University of Latvia
Institute of Geodesy and Geoinformation
Boulevard Rainis 19
LV-1586 Riga
phone/fax +371 703 4436
http://www.rigasgeometrs.lv/

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Sauletekio al. 11, LT-10223 Vilnius
phone: +370 52 744 707
fax: +370 52 744 705
gi@ap.vgtu.lt
http://eupos.vgu.lt

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ASG-EUPOS
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Department of Geodesy, Cartography and Geographic Information Systems
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fax: +4822 62 83 206, +4822 73 75 43 8
biuro.eupos@gugik.gov.pl
http://www.asg-eupos.gov.pl/
Romania
ROMPOS
National Agency for Cadastre and Land Registration
B-dul Expozitiei Nr. 1 A, sect. 1
RO-012101 Bucharest
phone/fax: +40 21 224 06 14
dgc@ancpi.ro
http://www.cngcft.ro/dgc/

Russian Federation
Multifunctional Navigation-Information Centre
Russian Institute of Space Device Engineering
53, Aviamotornaya str. *
RU-111250 Moscow
phone:+7(495) 673 97 91
fax: +7 (495) 673 43 56
contact@mnicrisde.ru
http://www.mnicglonass.ru/
(* additional centres to be established)

Serbia
AGROS
Faculty of Technical Science
D. Obradovica Square 6
RS-21000 Novi Sad
phone: +381 21 485 2022
fax +381 45 8873
gitis@uns.ns.ac.yu
http://gpsweb.ns.ac.yu/

Republic Geodetic Authority
Buleva vojvode Mišića 39
RS-11000 Beograd
phone: +381 11 2650 886
fax: +381 11 2651 076
ogr@rgz.sr.gov.yu
http://www.rgz.sr.gov.yu/
http://agros.rgz.gov.rs/
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SKPOS
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Chlumeckeho 4
SK-82745 Bratislava
skpos@gku.sk
http://www.skpos.gku.sk/

Slovenia (Observer)
SIGNAL
Geodetic Institute of Slovenia
Jamova cesta 2
SI-1000 Ljubljana
phone: +386 1 20 02 937
fax: +386 1 425 06 77
gps@geod-is.si
http://www.gu-signal.si/
(Owner of SIGNAL: Surveying and Mapping Authority of the Republic of Slovenia,
Zemljemerska cesta 12, SI-1000 Ljubljana)

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Research Institute of Radio-Engineering
Measurements
271 Akademika Pavlova str.
UA-61054 Kharkiv
phone: +380 57 738 22 18
fax.: +380 57 738 41 12
khrs@kharkov.ukrtel.net
http://www.khrs.kharkov.ukrtel.net/

Acknowledgement

The participants of the Symposium, which took place in Berlin from November 11 to
14, 2008,
express their cordial thanks to the organisers of the Symposium, particularly EUPOS
and the Senate Department for Urban Development of the State of Berlin, for holding
such a successful meeting.
Links for further information on the Symposium:

Report and photos, only German (will be enlarged):
http://www.stadtentwicklung.berlin.de/internationales_eu/geoinformation/de/projekte/gnss
2008/index.shtml

Presentations in the Symposium, only English (soon downloadable):
http://www.stadtentwicklung.berlin.de/internationales_eu/geoinformation/de/projekte/gnss
2008/programm/index.shtml

Recommendations of the Symposium, only English:
http://www.stadtentwicklung.berlin.de/internationales_eu/geoinformation/de/projekte/gnss
2008/recommendations.shtml

All information will be in English downloadable as soon as possible in the
EUPOS website
http://www.eupos.org/
Thank you for your attention!

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Links:
http://www.eupos.org
http://www.stadtentwicklung.berlin.de/geoinformation/
http://www.stadtentwicklung.berlin.de/internationales_eu/geoinformation/