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European Position Determination System (EUPOS®)

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1. GENERAL

- ◆ DGNSS systems are an important element for the effective modern multifunctional realization of GNSS.
- ◆ Such systems are being established in many counties of Europe and other parts of the world.
- ◆ The European Positioning Determination System (EUPOS) is a system of that kind for the countries in Central and Eastern Europe (CEE). It is based on the ground of the up-to-now development of these systems and on the base of the future development of GNSS.

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2. CORE OF THE EUPOS - DGNSS SYSTEM FOR CENTRAL AND EASTERN EUROPE

- The project European Positioning Determination System (EUPOS®) is an initiative with the aim to establish a uniform multifunctional DGNSS basis infrastructure in Central and Eastern Europe (CEE) on the base of the common reference frame ETRS89, unified data formats and international standards.
- EUPOS is a regional extension compatible to the running "German National Survey Satellite Positioning Service" SAPOS®. Existing European infrastructures will be taken into account, particularly EUREF as a fundamental realisation of the ETRS89.
- EUPOS will provide DGNSS correction data based on a network of permanent GNSS reference stations for real time positioning and navigation as well as GNSS observation data for post processing positioning
- EUPOS will be able to support precise positioning and navigation with high accuracy (metre, sub-metre, centimetre in real time and centimetre and sub-centimetre in post processing) as well as with guaranteed availability and quality.
- EUPOS is a system and service for realisation of GNSS applications to meet requirements of a wide spectrum of users.
- As a regional GNSS realization EUPOS® would be able to support GALILEO and EGNOS.

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3. PREPARATION STATE OF THE PROJECT

3.1. Scope of the project

- ◆ 13 Central and Eastern European countries: Republic of Bulgaria, Czech Republic, Republic of Estonia, Republic of Hungary, Republic of Latvia, Republic of Lithuania, Republic of Macedonia, Republic of Poland, Romania, Serbia and Montenegro, Slovak Republic, Republic of Slovenia and Russian Federation (figure 1, 2, table 1) and advisory the states Berlin and Hamburg of the Federal Republic of Germany involved (figure 1)
- ◆ Surface covered - area of more than 10 million km².
- ◆ Locations of the active permanent reference stations are selected in the particular countries as distance between reference stations are about 70 km. (Except Slovenia 50 and Macedonia 60)

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Fig. 1: Planned and available EUPOS® reference stations

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Fig. 2: Planned and available EUPOS[®] reference stations in the Russian Federation

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Country	Areas in km ²	Number of the planned EUPOS [®] GNSS reference stations (incl. ex.)	Number of existing GNSS reference stations	Average distance between the stations in km
First category "EU member countries"				
Czech Republic	78.870	16	2	70
Estonia	45.220	13	3	60
Hungary	93.000	19	5	70
Latvia	64.600	14	2	70
Lithuania	65.300	13	1	70
Poland	323.520	75	13	70
Slovak Republic	49.035	12	2	65
Slovenia	20.270	8	1	50
Second category "EU candidate countries"				
Bulgaria	110.950	23	1	70
Romania	237.500	48	6	70
Third category "West Balkan States"				
Macedonia (FYROM)	25.330	8	1	60
Serbia and Montenegro	88.360	18	1	70
Fourth category "Russian Federation"				
Russian Federation	17.075.000	150 (will cover only some main regions)	The reference stations will be built up in regions where none exist at the moment.	70-100

Table 1: Number of planned and available reference stations including existing infrastructures

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3.2. Organisational structure

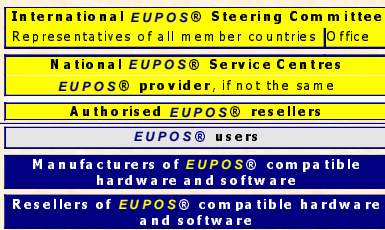


Table 2: EUPOS[®] organisational structure

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3.3. Technical specifications

- Uniform world-wide unlimited usable standards, guaranteed downward compatibility in cases of further development give equal opportunities and investment security to industry, users and provider
- Galileo (duty), NAVSTAR-GPS (first: duty, later: option), GLONASS (option)
- EUPOS DGNS correction data obtained to the European Terrestrial Reference System 1989 (ETRS89)
- Strive for availability of at least 99 % per annum
- One standard medium for all sub-services: Internet
- Optional medium radio for EUPOS real time sub-services
- Individual absolute calibrated GNSS antennas at EUPOS reference stations only
- One data format to provide EUPOS correction data: RTCM-EU
- Cross-border networking reference stations to provide area correction parameters (FKP)

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EUPOS[®] sub-services:

Sub-service EUPOS[®] DGNS

DGNS correction data for real time or post processing applications by code and code-phase measurements with an accuracy of 3 m up to 0.5 m and better.

Sub-service EUPOS[®] Network RTK

DGNS correction data for precise real time position determination by carrier phase measurements with an accuracy of about two centimetres.

Sub-service EUPOS[®] Geodetic

DGNS post processing applications by phase measurements in static or kinematic with centimetre up to sub-centimetre accuracy.

Possible sources of the project funding are for example different programmes of EC:

- EFRE – for all countries which become members of EU from 01.05.2004
- ISPA – for EU candidate countries Bulgaria and Rumania
- PHARE – for West-Balkan countries
- TACIS – for the Russian Federation

3.4. Deadlines

- Project preparation - 1.5 years. It is expected the preparation phase to be finished to the middle of 2005.
- 2.5 years are foreseen from the start of the project to its final realisation.

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4. STATE AND APPROACHES OF PROJECT DEVELOPMENT

- The work on the project preparation is based on regular workshops and ISC meetings, and adoption of respective resolutions and their implementation.

4.1. Workshops and resolutions

1st Workshop on Multifunctional GNSS Reference Station systems for Europe, Berlin, 4-5 March 2002 (Founding Committee established)

1st EUPOS ISC conference held in Warsaw, Poland, 2-3 July 2002

2nd EUPOS ISC conference held in Sofia, Bulgaria, 5-6 November 2002

3rd EUPOS ISC conference held in Riga, Latvia, 10-11 June 2003

2nd EUPOS[®] Workshop, Berlin, Germany, 20-21 November 2003

4th EUPOS ISC conference held in Berlin, Germany, 22 November 2004

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4.2. Approaches and activities for EUPOS development

- Implementation of the resolutions of the workshops and ISC
- Preparation of a project for *EUPOS* development,
- Realisation of Pilot projects,
- Establishment of an organisational structure,
- Finding of sources and funds, realisation of contacts, popularisation of *EUPOS*
- Part of the mentioned activities is in progress.

The works on the project are accomplished as well within the framework of the regular activities of the Office for Outer Space Affairs (OOSA) of UN, Vienna. The further development of the project has been included in the recommendations of the Vienna Workshops and of the Action Team of the Committee on the Peaceful Uses of Outer Space (COPUOS) for implementation of recommendation no. 10 of UNISPACE III on GNSS and GNSS Experts of UN/USA.

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Contacts with EC, ESA representatives have been established at the Conference "Galileo for an enlarge Europe" in 2003 in Warsaw and in Brussels as follows:

EC/GALILEO/EUPOS Brussels meeting:

- 1st meeting with GALILEO Joint Undertaking (GJU), Brussels, Belgium, November 12th, 2003
- 1st meeting with European Commission, EuropeAid Co-operation Office, Brussels, Belgium, November 12th, 2003

Popularization of the Recommendations

- Informing a large scope of specialists by respective publications and reports. Presentations have been given at a number of international meetings and forums, in national and other issues.
- Proposals for implementation of the OOSA Recommendations from different international and other organisations by their accepting in the topics and recommendations of the organised symposia and other scientific events.

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4.3. Approaches and activities for realisation of Pilot projects

- Important background for the entire project realisation
- 3-5 pilot projects (Sofia, Budapest, Riga, Moscow) have been foreseen for realisation as some of them are in progress
- Provisional number of the reference stations is 4-5 stations per pilot project.
- Funding
 - governmental, municipal and private sources,
 - industry (equipment, software and technologies),
 - other non-participating in the project countries,
 - public institutions and other resources.

4.4. Preparation of a project for EUPOS development

Resolution of the 2nd *EUPOS*® Workshop, Berlin, Germany, 20-21 November 2003 recommends:

- To put the *EUPOS* project into effect, applications are to be submitted for an umbrella project and, as soon as possible, for implementation-related projects.

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5. CONCLUSION

- The multifunctional DGNSS European Positioning Determination System – *EUPOS*® and the development of the *EUPOS* project is based on the correct concept, reliable ground, organization and intensive work up-to-now. It becomes popular and a lot of competent institutions support it.
- The preparation phase is advanced.
- For further preparation of *EUPOS* project it should be accomplished the proposals given above in item 4.
- Substantial progress in the preparation phase of *EUPOS* and as a whole, Further development and realisation of *EUPOS* is of a great many-side importance.

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