UNITED NATIONS OFFICE AT VIENNA **OFFICE DES NATIONS UNIES A VIENNE**
OFFICE FOR OUTER SPACE AFFAIRS

JOINT MEETING OF ACTION TEAM ON GNSS AND GNSS EXPERTS OF UN/USA REGIONAL WORKSHOPS AND INTERNATIONAL MEETING 2001-2002

8-12 December 2003, Vienna, Austria

PROGRESS ACHIEVED IN THE PREPARATION OF EUPOS

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1. OBJECTIVES AND AIMS OF THE PROJECT

- 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" SA*POS*®.
- *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, decimetre, 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.

2. RECOMMENDATION OF THE UN/USA EXPERT MEETING ON THE USE AND APPLICATION OF GLOBAL NAVIGATION SATELLITE SYSTEMS. Vienna, Austria, 11 - 15 November 2002 for the *EUPOS*® project

2.1. Working Group "Surveying, Mapping and Earth Science"

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Recommendation 2**:** To Establish the European Position Determination System's active reference stations to allow the large variety of users to determine their position with required accuracy.

Objectives

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- The development of integrated DGNSS "full scale accuracy" infrastructure with well-defined unified standards on regional levels (e.g. in Europe – EUPOS) is recommended.

2.2. Recommendations of the COPOUS Action Team on "Surveying, Mapping and Earth Science"

. . .

2. Expand the development of integrated Differential GNSS "full scale accuracy" infrastructure with well-defined unified standards on regional levels (i.e. in Europe: EUPOS).

A subject of further discussions within the framework of UN/USA regional workshops would be the problems on the multi-functional DGNSS applications in Central and Eastern Europe like EUPOS, its development for entire Europe and eventually as an element of GALILEO and EGNOS. Similar DGNSS systems can be developed for other regions in the world.

3. PREPARATION STATE OF THE PROJECT

3.1. Scope of the project

Institutions from 14 European countries and advisory the states Berlin and Hamburg of the Federal Republic of Germany work together to build up uniform DGNSS reference station systems, which will cover an area of more than 10 million square-kilometre in Republic of Bulgaria, Republic of Croatia, 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, table 1).

The locations of the active permanent reference stations are selected in the particular countries (figure 1). The distance between reference stations could not be greater than about 70 km at maximum for complete *EUPOS*® functionality.

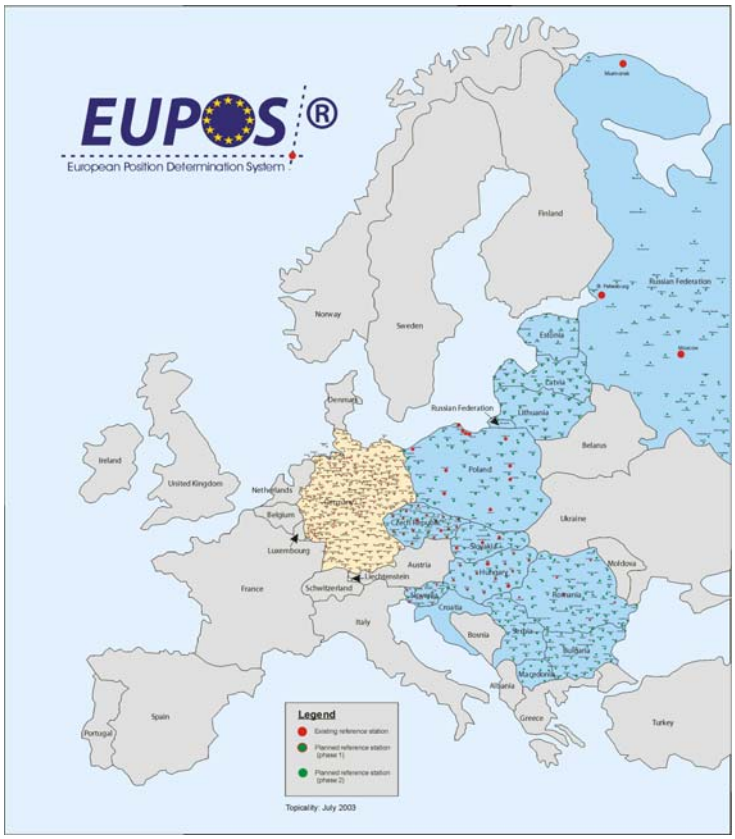

Fig. 1**:** Planned and available *EUPOS*® reference stations (only 260 reference stations at last, cf. table 1 and paragraph 4.2)

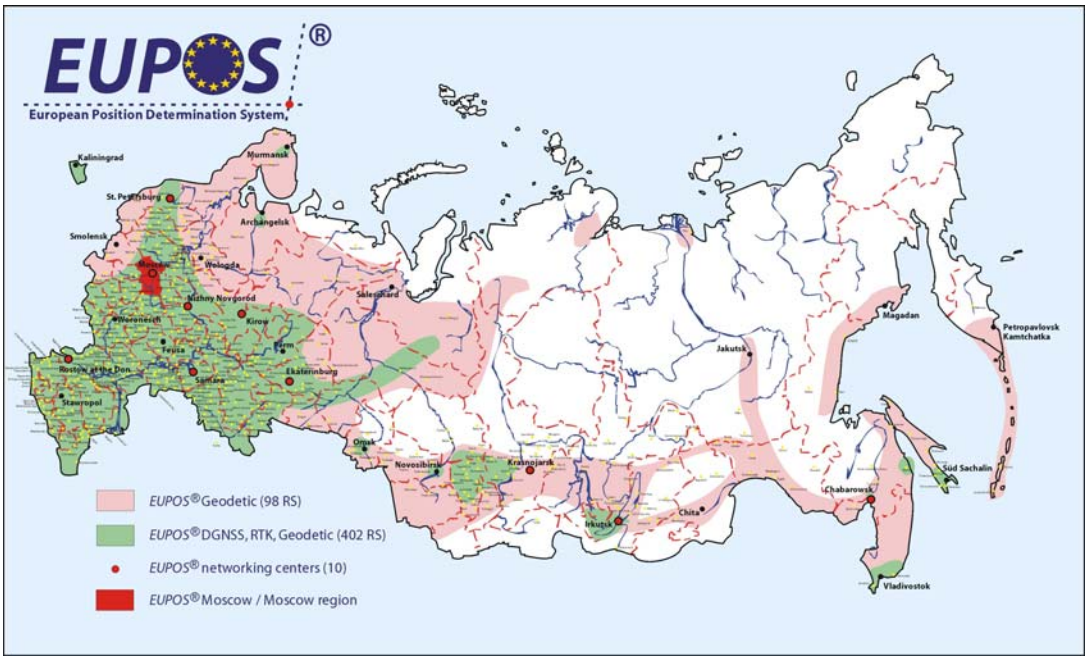

Fig. 2**:** Planned and available *EUPOS*® reference stations in the Russian Federation (500/150 reference stations, cf. table 1 and paragraph 4.2)

Country	Area [km^2]	Number of reference stations
Bulgaria	110,950	23
Croatia	55,540	11
Czech Republic	78,870	16
Estonia	45,220	10
Hungary	93,030	19
Latvia	64,600	13
Lithuania	65,300	13
Macedonia	25,330	8
Poland	323,520	66
Romania	237,500	48
Russia	9,286,500 (from17,075,000)	500 (150) [1)]
Serbia	88,360	18
Slovak Republic	49,035	10
Slovenia	20,270	4
Sum	**10,550,00**	**760 (410)** [1)]

[1)] It is planned to finance 150 reference stations by the *EUPOS* project and 350 only by the Russian Federation

Table 1**:** Number of planned and available reference stations including existing infrastructures, cf. paragraph 4.2

3.2. Organisational structure

Steering Committee was established in the initiating phase of the project, which was transformed into an International Steering Committee (ISC).
The *EUPOS*® ISC decided an administrative organisational structure particularly for the realisation phase and the operation phase, too (table 2).

International *EUPOS*® Steering Committee	
Representatives of all member countries	Office
National *EUPOS*® Service Centres	
***EUPOS*® provider**, if not the *EUPOS*® NSC itself	
Authorised *EUPOS*® resellers	

Table 2**:** *EUPOS*® organisational structure

International *EUPOS*® Steering Committee
The *EUPOS*® ISC is responsible for all tasks, which need an international co-ordination. The most important duties are:

- Product definition
- Standardisation
- Information, particularly by the *EUPOS*® Web pages, the annual *EUPOS*® workshop, the *EUPOS*® symposia, prints
- Agreements with the National *EUPOS*® Service Centres (*EUPOS*® NSC)
- Agreements with manufacturers of *EUPOS*® compatible hardware and software
- Organisation and co-ordination of software and hardware tests in cases of new developments in agreement with *EUPOS*® standards, carried out by *EUPOS*® NSCs and manufacturers
- Support of the *EUPOS*® initiative as uniform basis infrastructure for Europe going beyond the *EUPOS*® project of the involved CEE countries.

The *EUPOS*® ISC Office (*EUPOS*® ISCO) co-ordinates and prepares the works of the *EUPOS*® ISC. In this mind it is the central *EUPOS*® point of contact for interest of international importance (ISCO@eupos.org). The *EUPOS*® ISC is headed by Gerd Rosenthal, Germany.

National *EUPOS*® Service Centres

For each *EUPOS*® country an *EUPOS*® Service Centre (*EUPOS*® NSC) will be established in order to deal with the tasks of planning, establishment and maintenance of the national *EUPOS*® network. Beyond these activities the most important tasks of the *EUPOS*® NSCs are the following:

- Check the integrity of the network
- Provide adequate information for the users about the status of the network
- Organise educational and training courses for the users on the *EUPOS*® applications and for the *EUPOS*® technical staff
- Increase awareness among potential users
- Keep contact with the *EUPOS*® ISC and the *EUPOS*® ISCO
- Keep contact with the national authorities and interested governmental bodies
- Keep contact to the *EUPOS*® providers if the *EUPOS*® NSC doesn't provide *EUPOS*® by itself.
- Follow the international development trends and contribute to the *EUPOS*® developments
- Contribute to the *EUPOS*® application development in the host country by technology transfers or by own research and development activities
- Carry out software and hardware tests in agreement with the *EUPOS*® ISC and in their own interests

***EUPOS*® provider and authorised *EUPOS*® reseller**

There would be different ways to distribute *EUPOS*® tasks in several member countries. It is the decision of every member country itself how to organise *EUPOS*®. The *EUPOS*® NSCs are needed particularly in an interface function between international an national activities. It would be possible that an *EUPOS*® NSC provides *EUPOS*® by itself as well as that the *EUPOS*® provider would be another institution, agency, licensed company etc. but in any case the *EUPOS*® provider is interface to the *EUPOS*® user.

It would be possible, too, that a country management decides to authorise *EUPOS*® resellers. In this case, the *EUPOS*® reseller would be an additional *EUPOS*® user interface.

3.3. Technical specifications

EUPOS® fulfills the demands on a basis infrastructure with the use only of worldwide-unlimited usable procedures and data formats as well as by a guaranteed downward compatibility. The decided technical *EUPOS*® standards are either international standardised or based on other world-wide unlimited usable methods when the available international standardisation have not been including the requested features. The *EUPOS*® standards are to be used exclusive for a defined time period. Changes of the standards need an *EUPOS*® ISC resolution. Thus there is given a good basis for establishing a unified multifunctional ground based DGNSS infrastructure in Central and Eastern Europe as well as the needed security for investment to the industry, users and providers..

The GNSS Galileo will be the basis standard when available, the use of GPS and GLONASS are additional optional standards. Until the complete Galileo availability the GPS will be used as basis standard. The distances between the reference stations are about 70 km. Existing infrastructures, e.g. EUREF, are integrated into the *EUPOS*® network. A common cross-border use of reference stations of neighbouring countries is taken into account. The *EUPOS*® reference stations will be networked, even cross-border. It is striven a permanent *EUPOS*® availability of at least 99 % per annum, particularly by adequate technical measures. The obligatory standard media to provide *EUPOS*® data is the Internet, the information could be used wireless e.g. via mobile phone. Beyond this real time GNSS correction data could be provided optional by radio broadcast like 2-m-/4-m-radio, public broadcast, TV broadcast etc. That makes it possible to fulfil regional specific requirements. The user is able to select the favourable reference station directly or dependent of his topical position automatically when Internet is used. Using radio the reference station selection is dependent of the transmitter frequency. *EUPOS*® data obtained the European Terrestrial Reference System 1989 (ETRS89).

There exist three types of the *EUPOS*® sub-services:

Sub-service *EUPOS*® DGNSS

The *EUPOS*® DGNSS sub-service provides encoded and compressed DGNSS 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, dependent on the used rover station equipment.

Sub-service *EUPOS*® Network RTK

The *EUPOS*® Network RTK sub-service provides encoded and compressed DGNSS correction data for precise real time position determination by carrier phase measurements with an accuracy of about two centimetres.

Sub-service *EUPOS*® Geodetic

The *EUPOS*® Geodetic sub-service supports DGNSS post processing applications by phase measurements in static or kinematic with centimetre up to sub-centimetre accuracy.

3.4. Evaluation of the project and funding

On the base of estimated calculations from the different participating countries including investments, personal etc. the total costs of the project amount to 50 million EURO (cf. paragraph 4.2).

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

- ERDF – for all countries which become members of EU from 01.01.2004
- ISPA – for EU candidate countries Bulgaria and Rumania
- PHARE – for West-Balkan countries
- TACIS – for the Russian Federation
- OOSA – for project preparation phase (including conferences, ISC meetings etc.)

3.5. Deadlines

- Project preparation - 1,5 years
- 2,5 up to 3 years years are foreseen from the start of the project to its final realisation.

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

The major result of the workshop is the foundation of the Founding Committee by the participants from 16 countries with the aim to set up multifunctional SA*POS*® analogous reference station systems in interested Central and Eastern European states.

62 persons from 16 European countries participating during the workshop.

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

Main resolutions and agreements

- The establishment of a multifunctional system of DGNSS reference station will be pushed in one unified project called EUROPEAN POSITION DETERMINATION SYSTEM (*EUPOS*). *EUPOS* name and logo shall be registered Europe-wide
- It will be tried to realise the project *EUPOS* as an EU programme Instrument for Structural Polices for Pre-Accession (ISPA) for the EU pre-accession countries
- For countries which are not the EU pre-accession ones other possibilities of founding will be searched
- Existing infrastructures, e.g. EUREF, should be integrated
- The founding committee has been renamed as the *EUPOS* International Steering Committee (ISC)
- Establishment of the *EUPOS* ISCO, headed by Gerd Rosenthal, Berlin, Germany

- Countries that will join this project are obliged to observe the defined and uniform *EUPOS* standards

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

Main resolutions and agreements

- Wording a generalised project description, individualisation for every *EUPOS* member country
- Fixing of the *EUPOS* web pages contents (www.eupos.org). Webmaster is Prof. Janusz Sledzinski, Warsaw, Poland.
- The *EUPOS* ISC decline the suggestion to enlarge the *EUPOS* ISC because the ISC shall remain a small effective group.
- *EUPOS* ISCO will contact the European Commission.
- An officially *EUPOS* report will be given by Prof. Milev, Sofia, Bulgaria, to the UN/USA International Meeting of Experts in the Use and Application of Global Navigation Satellite Systems, Vienna, Austria, 11-15 November 2002.

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

Main resolutions and agreements

- The *EUPOS* ISC offered Montenegro to join the *EUPOS* project.
- The *EUPOS* ISC decided the generalised *EUPOS* project description.
- The *EUPOS* ISC decided the *EUPOS* Standard Summary.
- It will be tried to realise the project *EUPOS* as an EU programme Community Assistance for Reconstruction, Democratization and Stabilization (CARDS) for the non-EU pre-accession countries Croatia, Macedonia, Serbia and Montenegro and Technical Assistance to the Commonwealth of Independent States (TACIS) for the Russian Federation.
- For countries which are not the EU pre-accession ones other possibilities of founding will be searched
- The contact to further companies has to take place not integrated in the *EUPOS* ISC but in a different way, e.g. on workshops or special *EUPOS* ISC meetings.

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

Main resolutions and agreements

- The participants in the Workshop on EUPOS Multifunctional GNSS Reference Station Systems for Europe would like to express their heartfelt thanks for the work carried out so far by the International EUPOS Steering Committee, the member states and, in particular, the states of Berlin and Hamburg. In order to ensure that the efforts to set up EUPOS can continue, the institutions mentioned above are requested to continue their efforts in a systematic manner.
- The Workshop calls for the setting up of the National EUPOS Service Centers (NSCs) to be completed as an urgent priority. It is important for the NSCs to begin their work as national, state-authorised bodies for EUPOS. This is a precondition for the acceptance of the project at the national and international level as well as for the start of negotiations on the acquisition of EU funding.
- The EUPOS ISCO report is accepted. The Workshop adopts the EUPOS Standard Summary in the version of 8 September 2003 and the EUPOS Project Description.
- 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.

4.2. Approaches and activities for EUPOS development

The project development is related to the preparation of the project itself, providing of the necessary funds, establishment of a respective infrastructure and organisation, training of the personal etc.
At the present stage it is related to the 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.*
The realisation of a part of the mentioned activities is in progress.
Some EC programmes and other sources are also given in item 2 (*Evaluation of the project and funding*) as eventual funds. It is necessary to be found new resources, as well. It concerns the project preparation, which is very difficult at this stage on the base of own funding of the participation countries. In this respect the support of OOSA will be very effective. OOSA would deliver a support in the following aspects:

- Direct support by own funds or other funds supplied by it (for project preparation, including workshops, ISC meetings etc.)
- Indirect support
  - specifying the financial sources
  - letters of recommendation to different institutions financing *EUPOS* activities and *EUPOS* pilot projects.

Along with that *EUPOS* ISCO recommends reducing the *EUPOS* project costs by

- Retention the originally decided reference station density from 70 km altogether
- Evaluation of the question about national independence of *EUPOS* reference station systems versus cross-border system design
- Reduce of the Russian *EUPOS* project on a very smaller area
- Thus would reduce the *EUPOS* project costs about 50 % at least.

- ♦ Decide a realistic time schedule with the aim to propose *EUPOS* applications via the national responsible persons for EU promotional programme to the EC
- ♦ *EUPOS* ISC report to the Joint Meeting of Action Team on Global Navigation Satellite Systems and Global Navigation Satellite Systems Experts of UN/USA Regional Workshops and International Meeting 2001-2002, 8-12 December 2003, Vienna, Austria. Try to receive support to *EUPOS* ISC by UN Committee on the Peaceful Uses of Outer Space
- ♦ Check EU promotional programmes support to international *EUPOS* ISC activities, EUPOS workshops etc.
- ♦ Check the 2nd call on the EU 6th Framework Programme particularly for *EUPOS* pilot projects as test-beds
- ♦ Check the Stability pact for Balkan-countries (transport of energy, electricity, gas, oil)
- ♦ Take into account White Russia and particularly Ukraine for a later *EUPOS* integration

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

EC/GALILEO/*EUPOS* Brussels meeting results
1st meeting with GALILEO Joint Undertaking (GJU), Brussels, Belgium, November 12th, 2003

Participants
- GALILEO Joint Undertaking (General Counsellor, Technical Division, Business Development Division)
- *EUPOS* (ISCO, Polish ISC member, Chancellery of the state Berlin, Berlin Ministry for Urban Development)

Information exchange
- GALILEO Joint Undertaking founding, organisation and duties
- Need for and benefit of GALILEO local services, GALILEO local components
- *EUPOS* Initiative and *EUPOS* project

Results
- Higher accuracy than provided by GALILEO is needed
- GJU accepted the planned 2.5 - 3 years short-time establishment of *EUPOS* after start as a very positive aspect
- GJU emphases importance of inclusion EU candidate countries and non EU candidate countries, too, in the *EUPOS* project
- Further contact and information exchange between GJU and *EUPOS* is agreed
- GJU will give information about *EUPOS* to the GALILEO concessionaire in future to make the contact
- 2nd call on the EU 6th Framework Programme about April/June 2004 will include test beds

1st meeting with European Commission, EuropeAid Co-operation Office,
Brussels, Belgium, November 12th, 2003

Participants

- European Commission, EuropeAid Co-operation Office (head of unit and colleague)
- *EUPOS* (ISCO, Polish ISC member, Chancellery of the state Berlin, Berlin Ministry for Urban Development)

Information exchange

- EuropeAid organisation and duties
- DG TREN, DG RELEX, DG Enlargement duties
- *EUPOS* Initiative and *EUPOS* project
- TACIS and CARDS budged and questions for application to these promotional programmes

Results

- EuropeAid recommended to make contact with DG TREN and DG Enlargement
- Topically TACIS priorities for Russia are reformation of public administration and security, privatisation of state-owned real estate, planned priority in 2004would be environment
- The planned *EUPOS* Russian Federation budged is topically to big (e.g. complete TACIS budged for Russia is about100 million EURO in 2004), reducing of project costs is needed
- EuropeAid recommended also reducing of *EUPOS* project costs altogether
- EuropeAid attract *EUPOS* attention to White Russia and particularly to Ukraine
- EuropeAid attract *EUPOS* attention to Stability pact for Balkan-countries (transport of energy, electricity, gas, oil)
- EuropeAid offers further meeting

Popularization of the Recommendations

Except the already done up-to-now for popularisation of the EUPOS project by reports at different international events it is relevant to be accomplish the following:

- Informing a large scope of specialists by respective publications and reports,
- 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.

4.3. Approaches and activities for realisation of Pilot projects

The pilot projects are an 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. The tentative number of the reference stations is 4-5 stations per pilot project.

The Pilot projects could be funded by governmental, municipal and private sources, by the industry providing equipment, software and technologies, funding by 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.

5. SUGGESTIONS AND CONCLUSION

For the further preparation and realisation of the project it is necessary to be accomplished the proposals given above in item 4.
In conclusion it would be necessary to emphasize once again that there is substantial progress in the presented in this report aspects of the EUPOS preparation phase and as a whole, and its further development and realisation is of a great many-side importance.

6. REFERENCE

Rosehthal, G. Bericht des EUPOS ISC. *EUPOS*® - Multifunctional GNSS reference station systems for Europe. 2nd Workshop, 21 - 22 November 2003, Berlin, Germany. 15