

Active Geodetic Network of Serbia

Oleg ODALOVIC and Ivan ALEKSIC, Serbia

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SUMMARY

In June 2003 the Republic Geodetic Authority (RGZ) has started the realization of the project of establishment of network of the permanent stations in the Republic of Serbia, under the name of Active Geodetic Referent Network of Serbia (AGROS).

With the cooperation with the Faculty of Technical Science, University of Novi Sad by the end of 2005 over 80% of the territory of Serbia has been covered.

This analysis gives the short outline of the technical standards of the network, its current state and the future activities planned by RGZ for the purpose of its establishment.

1. INTRODUCTION

The mid term plan of works of the Republic Geodetic Authority includes the establishment of the permanent station network in the entire territory of Serbia.

The objective of this RGZ project is to solve a wide range of tasks from below listed fields, in a highly efficient, simple and economically justified manner. Those fields are:

- Survey and cadastre,
- Traffic control and gathering statistic information ,
- Traffic management,
- Vehicle navigation,
- Navigation for the purpose of tourism,
- Providing services to authorities and organizations in the security area,
- Providing services for agriculture and forestry works,
- Providing services in the projects for preservation and protection of the environment
- Climate testing and weather forecast Air traffic support
- Support for air photogrametric photography and the laser scanning of the terrain
- Support to the projects from the field of hydrographic Providing services for the river traffic,
- Support to the establishment of GIS system,
- Support for the engineering technical works,

as well as a hall range of other activities which form an integral part of the wide range of entrepreneurship activities and scientific research.

The activities on the establishment of the network have started in December 2001 with the

preparation of the required technical documentation, and in February 2002 cooperation was established with the European Academy of Science for Urban Environment in the specific task of establishment of the network of permanent stations in 16 countries of the Central and East European region, also known as EUPOS (European Position Determination System).

At that time it was decided that, after the unification of the technical standards, the existing AGROS project would become a sub-project of the EUPOS system.

RGZ has started the realization of the project in June 2003. with the cooperation of the Faculty of Technical Science, University of Novi Sad, and the Army of Serbia and Montenegro, and it is expected that the entire area of Serbia should be covered by the middle of 2005, at the latest.

2. BASIC DATA

AGROS was designed as a central system comprised of three internally linked segments: segment comprised of permanent stations, communications segment and user segment.

2.1 Permanent station segment

In accordance with the AGROS I project, this segment consists of permanent stations with clearly defined characteristics of the devices, stabilization and positioning in the field:

- the permanent stations should, with relative regularity, cover the entire territory of Serbia,
- the average distance between the stations should be ~70 km
- the receivers should be high-quality GPS receivers with minimum 12 channels (at least two receivers in the network should have 20 channels)
- the antenna of the receiver should be installed in stable terrain, and should be at a distance from any devices that could be the potential sources of the electromagnetic radiation (passive or active),
- elevation mask should be 15° and the area above the elevation mask should be such to provide unhindered reception of satellite signals.

Based on the above listed parameters, dispositions of the permanent stations were determined and adopted, and they are shown in figure 2.

2.2 Communication and user segment

Communication segment basically consists of the following: the control center, telecommunications components which provide the link between the GPS segment and the control center and the telecommunications component required for establishing the connection between the control center and the user segment.

The structure of the control center should provide the receipt of the data from the permanent station, their processing and further communication with the users. According to these requirements, through AGROS design solution, following (minimum) configuration of the control center was defined: computer with appropriate applicable software for control center backup, server for the receipt of data from the permanent stations and for communication

with the users.

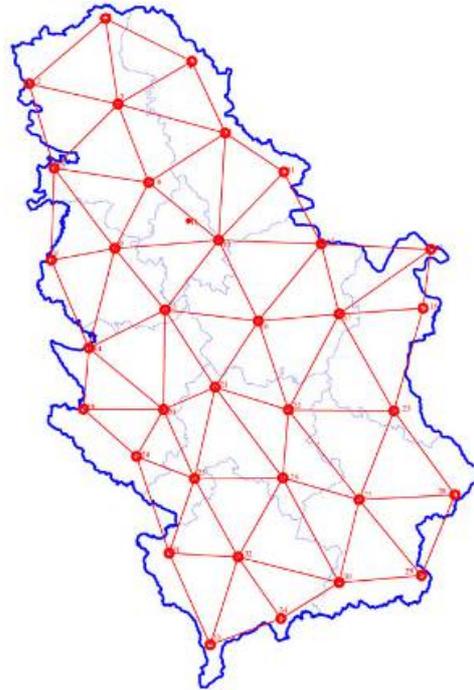


Figure 1. Spatial distribution of permanent station – project AGROS

The permanent stations should have permanent communication with the control center through classic analog or digital telephone lines, whereas the users should use internet, GPRS or GSM technologies, all this through three user services:

- for positioning in real time with accuracy 0.5-3 m,
- for positioning in real time with accuracy 2 cm and
- for highly precise geodetic measurement (postprocessing).

This project also defines the terms of communication between the control center and the users, in the following manner:

- in the case of first service, through the use of standard data formatting RTCM SC 104 V.2.0. (Bagge, 2001),
- in the case of second service, RTCM SC 104 V. 2.3. together with 20, 21 type of messaging and RTCM message type 59 for backup of the network operation in the FKP regime,
- while the takeover of data which is provided by the third service should be based on the international standard data format RINEX 2.0 (2.1, ...) (Gurtner, 1998).

3. ESTABLISHMENT OF AGROS

Network was mentioned for the first time in the documents of Republic Geodetic Authority while preparing budget expenses for the year 2002, and for the first time publicly the idea on establishing of AGROS was brought up at the national Geodetic meeting of Serbia in 2002.

Also in 2002 the Republic Geodetic Authority whit Technical Science Faculty in the city of Novi Sad accomplishes the agreement about establishing of AGROS and the realization starts in 2003. The realization was done in tree steps. In the first one in 2003 one control center in Novi Sad were established and 9 permanent stations in the territory of Vojvodina. In the second step in 2004 another 10 permanent stations were established in the central part of Serbia, while the third step with additional 12 stations started and finished in 2005. In the territory of Kosovo and Metohija by the project 4 stations were planed but up to now they have not been established. Spatial distribution of permanent stations is given in figure 2 where from it can be seen that besides of planed permanent stations additional two were constructed in Novi Sad (Faculty of Technical Science) and in Beograd (Geodesy Institute, Civil Engineering Faculty, University of Beograd).

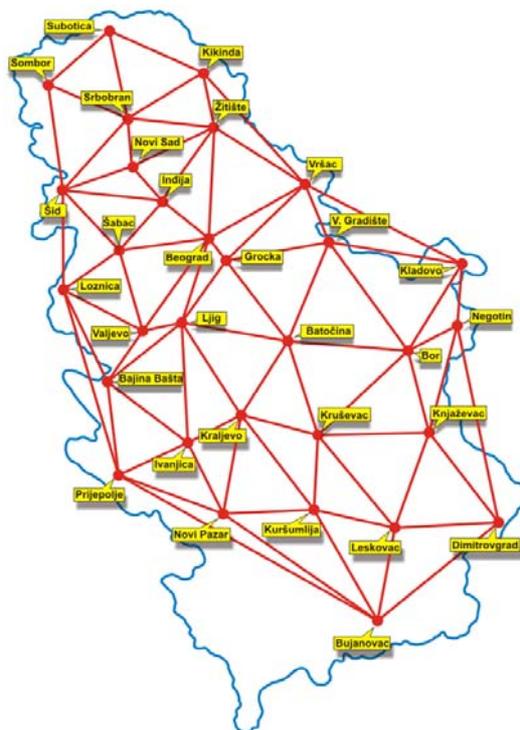


Figure 2. AGROS - Current state

Through of this time while AGROS was establishing services were available to users and in December 2005 after the third step had been over usage of network started on economy basis and all of three, by project defined services are in usage.

4. CONCLUSION

In the period of three years Republic Geodetic authority and the Faculty of Technical Science in Novi Sad established network of permanent stations - AGROS in the 80% of the territory of Serbia (i.e. the whole territory without Kosovo and Metohija).

Basic usage of AGROS up to now has been to established and maintain geodesy basis of Serbia as well as to measure for the purposes of Real Estate Cadastre.

Presently, AGROS has over 40 users on the economy basis and the services of the system are in use freely by academy institutions of Serbia.

In the mid of the year 2005 5 permanent stations of AGROS became candidates in consortium of CEGRN and entering in certain number of European project is planed.

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CONTACTS:

Dr. Ivan Aleksic
Director, Republic Geodetic Authority of Serbia
Bulevar Vojvode Misica 39
Beograd
Srbija
Tel. +38163358270
Fax + 381112650445
Email: rgz@EUnet.yu
Web site: www.rgz.sr.gov.yu

Dr. Oleg Odalovic
Assistant Director, Republic Geodetic Authority of Serbia
Bulevar Vojvode Misica 39
Beograd
Srbija
Tel. +38163203674
Fax + 381112650445
Email: olego@sezampro.yu
Web site: www.rgz.sr.gov.yu