LITPOS – A SERVICE FOR PRECISE POSITIONING IN REAL TIME

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ABSTRACT

LitPOS – the state network of permanent reference GNSS stations – is operational from July 2007. It provides data both for the real-time and post-processing applications. LitPOS stations cover the all territory of Lithuania. Total number of GNSS stations is 25 therefore the integration of some stations of neighbouring countries is foreseen. It is possible on the basis of cooperation in *EUPOS®* project.

The European Position Determination System (*EUPOS®*) project is an initiative and cooperation of currently 15 Central and Eastern European countries (CEE) and two German states that build up a ground based European regional GNSS augmentation system with uniform standards that will cover a territory of about 10 million square kilometers. *EUPOS®* provides high quality differential GNSS information for high precise positioning and navigation usable in a large field of applications.

LitPOS is a multipurpose GNSS infrastructure for Lithuania. LitPOS combines a network of base GNSS stations with dedicated communication channels and appropriate hardware and software. Its main objective is to provide the 24/7/365 real time precise positioning service with national-wide coverage for the geodetic, cartographic, cadastral and construction applications.

KEYWORDS

GNSS infrastructure, LITPOS, EUPOS, real time precise positioning

1. INTRODUCTION

LitPOS is a new GNSS infrastructure for Lithuania. GNSS stations will be operational in July 2007. Its main objective is to provide the 24/7/365 real time precise positioning service with national-wide coverage for the geodetic, cartographic, cadastral and construction applications. LitPOS combines a network of base GNSS stations with dedicated communication channels and appropriate hardware and software.

Main developers are:

- National Land Service under the Ministry of Agriculture – financial support and supervising;
- Private company "GPS Systems Baltija" – software and hardware;

- State enterprise "Infostruktūra", private company "FIMA" – infrastructure (dedicated Intranet lines, electric power supply);
- Geodetic Institute of VGTU – acting as overall coordinator and LitPOS operator.

Objectives of LitPOS:

- to foster the implementation of GNSS techniques in Lithuania;
- to support a broad spectrum of GNSS based applications in positioning and navigation;
- to economize precise geodetic and cadastral surveying and to bring better comfort to surveyors;
- to provide the 24/7 real time positioning service with national-wide coverage;
- to harmonize the national geodetic infrastructure with the EU countries and to facilitate the implementation of ETRS and EVS.

2. LITPOS - GENERAL FEATURES

LitPOS – a Multipurpose Positioning System for the Lithuania. It is an active network of permanent GNSS stations (Figure 1).

LitPOS stations become very important geodetic points having the combined set of geodetic parameters:

- Coordinates to LitPOS stations are transferred from National Zero Order GPS Network and EPN stations [1-4].

Figure 1. Distribution of LitPOS stations

- Geopotential heights and normal heights of National First Order Vertical Network are used for data transfer to LitPOS stations [5, 6].
- Gravity values of National Zero and First Order Gravimmetric Network are used for data transfer to LitPOS stations [7, 8].
- Height transfer from National Vertical First Order Network by precise levelling to GNSS station benchmark, and height transfer from it to antenna pier by trigonometric levelling (using total station).

Services and Products provided by LitPOS:

- Real-time services: RTK (Real-Time Kinematic) using VRS (Virtual Reference Station) technology; and real-time DGPS service;
- Post-processing products: RINEX data files for further processing.

So LitPOS will provide the 24/7/365 real time precise positioning service with national-wide coverage for the geodetic, cartographic, cadastral and construction applications. That means, that it will contribute for large scale information dissemination, for example, Lithuanian Geographic Information Infrastructure [9–11].

3. LITPOS NETWORK STRUCTURE

Total number of GNSS stations is 25. They are communicating with 2 central servers using dedicated intranet lines.

Instrumentation of 15 stations (Figure 2): Trimble NetRS receivers with Chock ring antennas, TRIMMARK 3 RADIO MODEMS, PTU200 Combined pressure, humidity and temperature transmitters, DSL modem, AC adapter 12V, e-Power Switch, UPS, electric power gauge.

Instrumentation of 10 stations (Figure 3): Trimble 5700 receiver with Zephyr geodetic antennas, Com server, DSL modem, AC adapter 12V, e-Power Switch, UPS, electric power gauge.

Typical view of GPS antenna mounted on the roof of fire station is presented in Figure 4.

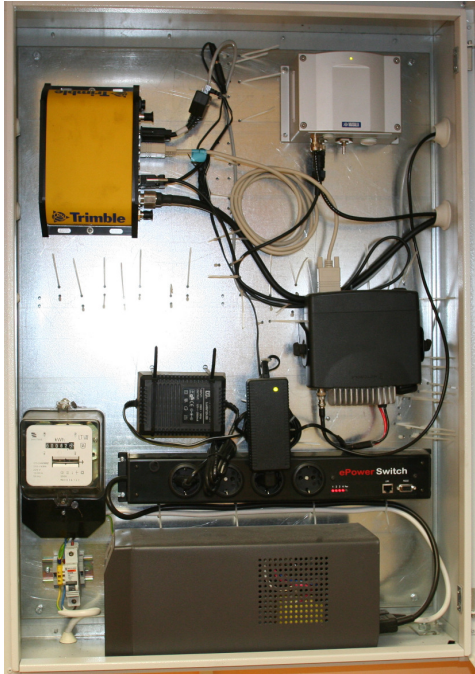LitPOS hardware of operating centre consists of 3 PC and 2 servers (Figure 5).

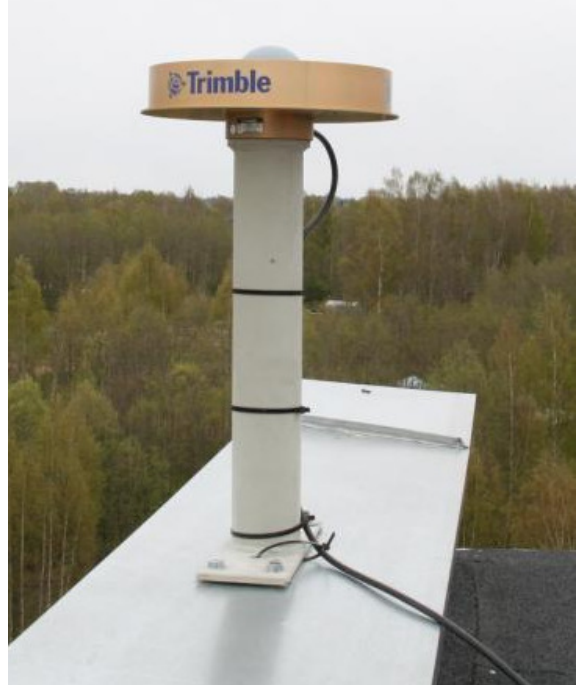Figure 2. LitPOS station with Trimble NetRS receiver

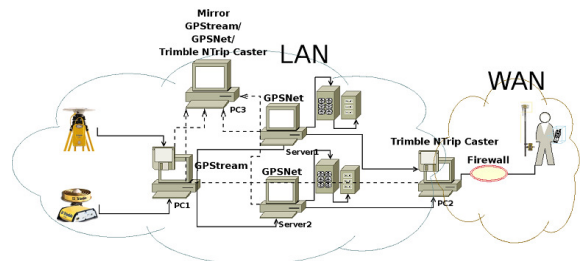Figure 4. GPS antenna on the roof of fire station tower

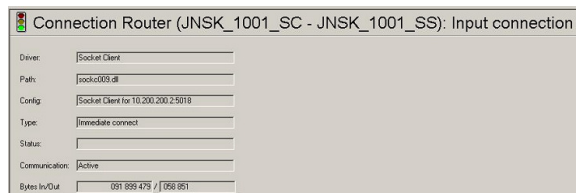Figure 5. Principal scheme of hardware and data flows

Figure 6. Example of connection router to station JNSK

LitPOS software modules are: GPStream (Figure 6), GPSNet (Figure 7), NTRIP Caster (Figures 8, 9).

Figure 3. LitPOS station with Trimble 5700 receiver

Figure 7. DGPSNet Processor window

Figure 8. Information on broadcasting stations

Figure 9. Information on broadcasting station JNSK

4. LITPOS – A PART OF EUPOS®

EUPOS® is both an international initiative and a project to establish and to provide a basis infrastructure particularly for positioning and navigation in Central and Eastern Europe (CEE) realized by ground-based multifunctional DGNSS reference station systems and services in the participating countries, which use agreed on uniform standards (Rosenthal *et al*. 2007). The *EUPOS*® ground-based GNSS augmentation system will cover about 25% of the European Union territory and more than 60% of the area of the whole Europe . Taking into consideration also the Russian territory in Asia where this infrastructure will be established, *EUPOS*® will be realized for an area of about 10 million square kilometers. Members of the *EUPOS*® cooperation are: Bosnia and Herzegovina, Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Macedonia, Poland, Romania, Russia, Serbia and Montenegro, Slovakia, Ukraine and the German States Hamburg advisory and Berlin as chair.

EUPOS® provides DGNSS correction data for real-time positioning and navigation as well as GNSS

observation data for post-processing position determination. *EUPOS*® is able to support precise positioning and navigation with high accuracy (meter, decimeter, centimeter in real-time and centimeter and sub-centimeter in post-processing) and with guaranteed availability and quality. *EUPOS*® is independent of private company solutions and uses only international standards and open standards.

At last more than 800 *EUPOS*® reference stations are planned currently: circa 500 stations by the Russian Federation and about 300 stations by the other participating countries. The progress of the *EUPOS*® system realization in the member countries is different since it depends on financial facts. Lithuania receives funding support by the EC and realizes the national *EUPOS*® system in 2007. The establishment of the reference station systems advances in the most *EUPOS*® member countries too [12].

The cooperation in the *EUPOS®* project enables to include into LitPOS the stations of neighbouring GNSS networks, and vice versa (Figure 10).
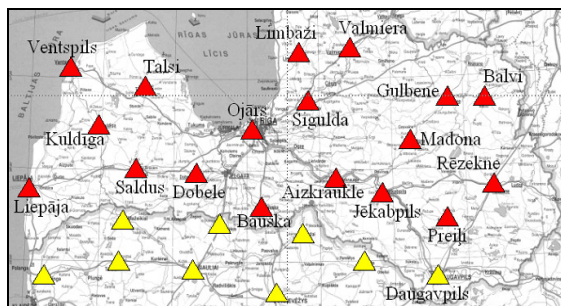

Figure 10. GNSS stations at Latvia-Lithuania border

5. CONCLUSIONS

1. LitPOS is a new geodetic infrastructure for referencing spatial geoinformation.

2. LitPOS provides the direct linkage to the National Coordinate System and height datum.

3. LitPOS provides the 24/7/365 real time precise positioning service with national-wide coverage for the geodetic, cartographic, cadastral and construction applications.

4. LitPOS is a part of *EUPOS®*.

5. Lithuanian *EUPOS®* website contributes for large scale information dissemination, for example, Lithuanian Geographic Information Infrastructure.

6. ACKNOWLEDGEMENTS

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