Albanian GNSS Network
National Report
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Key Words: ALBCORS, ASIG, CORS, CRS, KRGJSH-2010,
INTRODUCTION

- **Capital**: TIRANA
- **Current population of Albania**: ≈ 2,900,000
- **Total land area**: ≈ 28,000 Km²
- **Albania is an upper-middle-income country**
- **Strongest sectors of the economy**: energy, mining, metallurgy, agriculture, and tourism
- **Median age in Albania**: 36.4 years
- **Total number of staff**: 42
- **Average annual budget**: 0.5M €
State Authority for Geospatial Information (ASIG) was established in 2013, according to law 72/2012 "On the organization and functioning of the national infrastructure of geospatial information in the Republic of Albania”

In terms of executing the regulations of Law nr. 72/2012 and having regard the EU requirements related with CRS, we are engaged to establish a modern geodetic reference frame, based on GNSS technology, and will support accurate and efficient horizontal and vertical positioning throughout Albania!

ASIG is the responsible organization for establishment of Geodetic Reference Frame in Albania, including:

- National GPS Network (Active + Passive)
- National Gravimetric Network
- National Leveling Network
- National Tide Gauge Network
- Magnetometric Network
ROLE OF G.R.F FOR ALBANIA

- Improve the quality of existing Geo-information data (Create cadastral maps => prevent property conflicts; smooth transactions etc.)
- Provide accurate and reliable information for urban planning and decision making to territory administration.
- Support development of geographic information systems for planning and service management functions (boundary determination for site planning, land use regulation, hydrology, soil conservation etc.)
- Provide a reliable and accurate geodetic base to Surveying and Mapping companies for implementation of all engineering projects throughout our country (cost & time effective).
- Monitoring crustal deformation and tectonics activity (high demand from the Albanian Institute of Geosciences).
- Monitoring the distribution of precipitable water vapor in the atmosphere for weather prediction (Improve the countermeasures to floods).

Provide a common, accurate & reliable reference for positioning throughout Albania!
HISTORY OF GEODETIC WORKS IN ALBANIA

1970-1977
ALB86, Gauss Kruger (El, Krassovsky)

1970-1986

2007-2008
16 Roof Type Antennas.
75km aver. dist.
Maintained by Geographic Military Institute.
After 2014 system restarted operating at IPRO with support of Lantmäteriet (some stations changed locations)

2008
AlbPos

2013-2014

2019-2020

EUREF89 epoch 2008.0
GNSS Survey

ALBCORS

Established on 2008, (EU donation 1.7M €)
- 16 Roof Type Antennas.
- 75km aver. dist.
- Maintained by Geographic Military Institute.
- After 2014 system restarted operating at IPRO with support of Lantmäteriet (some stations changed locations)

Established on 2020, (ASIG investment 0.65M €)
- 21 ground pillars + 6 Roof Type Antennas.
- 35km aver. dist.
- Maintained by contractor company till 2024, supervised by ASIG.

KRGJSH, TM, ETRS89

Leveling
Triangulation
GPS Survey
Why a new CORS system?

Problems regarding previews ALBPOS system:

- **Week stability of antennas.**
- **Old equipment (>10 years).**
- **75km average distance,** need for more stations.
- **Not sustainable & not reliable.**
- **Not certified** (doesn’t fulfill national and EU requirements for CORS).
PHASES OF IMPLEMENTATION OF ALBCORS

- Drafting the technical project
- Technical Specifications and TOR
- Tendering and Criteria of the Winner Company
- Construction and installation of the new CORS system;
- Testing & system validation;
- Promotion activities & utilization of new CORS;
- Development of guidelines/manuals on maintenance of CORS;
- Provide services with the required accuracy/precision;
- Develop efficient methods for surveying by taking advantage of the evolving GNSS and communication technologies;
THE NEW GNSS NETWORK, ALBCORS

- 21 Active GNSS Pillar Point
- 6 Active GNSS Roof Point
- Ground reinforced concrete pillars
- Average distance: 40-50 km
- According to EU requirements
- Integration with the existing GNSS system of Inst. of Geosciences

Effects:

- Create a time-based dynamic Geodetic Reference frame.
- Implement & Maintain ITRS/ETRS in Albania.
- Provide a common and reliable reference for accurate gathering & creation of geo-information.
- Create Database for Land movement and crustal deformations (in cooperation with Albanian Institute of Geosciences).
- Improve counter-measures to floods and other natural disasters.
- Productive & efficient use of GNSS for engineering surveying works (time & cost effective).
- Support navigation and augmentation.
- Research purposes.
The construction of the NETWORK

Construction of 21 CORS pillars and 21 1st order passive GPS points

Field reconnaissance & site selection
<table>
<thead>
<tr>
<th><strong>Description</strong></th>
<th><strong>1</strong> NET S9 Receiver</th>
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<tr>
<td></td>
<td><strong>2</strong> Choke Ring Antenna CR3-G3</td>
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<td></td>
<td><strong>3</strong> Teltonika RUT955</td>
</tr>
<tr>
<td></td>
<td><strong>4</strong> Metallic case (Rack)</td>
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<tr>
<td></td>
<td><strong>5</strong> Plastic case (Box)</td>
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<td></td>
<td><strong>6</strong> Sunlight Batery100V</td>
</tr>
<tr>
<td></td>
<td><strong>7</strong> Solar Panel 100x80cm</td>
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<td></td>
<td><strong>8</strong> Automat 10A</td>
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<tr>
<td></td>
<td><strong>9</strong> Inverter Energjie 220v -&gt; 12V</td>
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<tr>
<td></td>
<td><strong>10</strong> Sim Card</td>
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<td></td>
<td><strong>11</strong> Automatic power source command</td>
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<tr>
<td></td>
<td><strong>12</strong> Solar Panel energy controller</td>
</tr>
<tr>
<td></td>
<td><strong>13</strong> Electric and internet cable</td>
</tr>
<tr>
<td></td>
<td><strong>14</strong> Thunder protection</td>
</tr>
</tbody>
</table>
The construction of the NETWORK

**ACTIVE GNSS PILLAR POINT**

**ACTIVE GNSS ROOF POINT**
ALBCORS monitoring center program (GNSMART, GEO++) consists of four modules:

I. Module for monitoring CORS RTK Service, administration of CORS network reference stations, and user management.

II. Module for compensation and calculation of data (corrections) in real time.

III. Module for post-processim GNSS.

IV. Module for the WEB page.
- The program also enables:
  - Registration of the users.
  - Downloading station data at different intervals (from 1-30 seconds) to RINEX format (versions 2 and 3).
  - Real-time computation of a GNSS multi-station solution of RTK service with sustainable accuracy, reliability and availability.
  - Graphic interface for:
    - Definition of correction models and parameters
    - Users position
    - Signal strength for stations
    - Corrections (ephemeris data, ionospher, multipath etc.)
A series of field measurements have been performed:

- RTK Method
- Static Method (Post-processing)

Instruments:
- GNSS Receivers, SOKKIA GRX2

Accuracy:
- RTK Method: +/- 2 cm (2D)
  +/- 3 cm (3D)
- PP Method: +/- 1 cm (2D dhe 3D)

Testing and sustainability of the network ALBCORS:
## Services that ALBCORS system provide

<table>
<thead>
<tr>
<th>ALBCORS service</th>
<th>Procedure/method</th>
<th>Data transfer manner</th>
<th>Accuracy</th>
<th>Data format</th>
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</thead>
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<tr>
<td>DPS differential positioning</td>
<td>code network solution in real-time</td>
<td>Wireless Internet (GPRS, UMTS, ...) NTRIP protocol, GSM</td>
<td>±0.3m to ±0.5m</td>
<td>RTCM 2.3, RTCM 3</td>
</tr>
<tr>
<td>VPPS highly precise positioning</td>
<td>network solution of phase measurements in real-time</td>
<td>Wireless Internet (GPRS, UMTS, ...) NTRIP protocol, GSM</td>
<td>±2 cm (2D), ±3 cm (3D)</td>
<td>RTCM 2.3, RTCM 3</td>
</tr>
<tr>
<td>GPPS Geodetic highly precise positioning</td>
<td>post-processing</td>
<td>Internet (FTP, e-mail)</td>
<td>±1cm (2D, 3D)</td>
<td>RINEX 2.1, RINEX 3</td>
</tr>
</tbody>
</table>
The service for a period of time (til 2020) it will be for free

There are around 200 active public and private users that use ALBCORS services

### Users of RTK and PP Service
- Municipalities
- State Authority
- Universities
- Civil Engineering
- Measurement consult
- National Land Survey
- Other

<table>
<thead>
<tr>
<th>Caster</th>
<th>Mountpoint</th>
<th>Identifier / Description</th>
<th>Format</th>
<th>Format Details (Rate)</th>
<th>Carrier Phase</th>
<th>GNSS</th>
<th>Network</th>
<th>Country Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMR_+</td>
<td>VRS</td>
<td>CMR+</td>
<td>1(1), 3(1)</td>
<td>L1 L2</td>
<td>GPS+GLO</td>
<td>ALB</td>
<td>ALBCORS</td>
<td>ALB</td>
</tr>
<tr>
<td>FKP01</td>
<td>FKP v31</td>
<td>RTCM31</td>
<td>1004(1), 1005(10), 1007(30), 1012(1), 1030(30), 1031(30), 1033(60), 1034(10), 1035(10)</td>
<td>L1 L2</td>
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<tr>
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<td>RTCM31</td>
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<td>ALBCORS</td>
<td>ALB</td>
</tr>
<tr>
<td>NSTA-GG</td>
<td>Nearest Station</td>
<td>RTCM32</td>
<td>1074(1), 1084(1), 1005(10), 1007(30), 1032(10), 1033(60)</td>
<td>L1 L2</td>
<td>GPS+GLO</td>
<td>ALB</td>
<td>ALBCORS</td>
<td>ALB</td>
</tr>
<tr>
<td>NSTAT</td>
<td>Nearest Station</td>
<td>RTCM32</td>
<td>1074(1), 1084(1), 1094(1), 1005(10), 1007(30), 1032(10), 1033(60)</td>
<td>L1 L2</td>
<td>GPS+GLO+GAL+BDS</td>
<td>ALB</td>
<td>ALBCORS</td>
<td>ALB</td>
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<tr>
<td>PRS-LEXY</td>
<td>PRS v30</td>
<td>RTCM30</td>
<td>1004(1), 1012(1), 1005(10), 1007(30), 1032(10), 1033(60)</td>
<td>L1 L2</td>
<td>GPS+GLO</td>
<td>ALB</td>
<td>ALBCORS</td>
<td>ALB</td>
</tr>
<tr>
<td>PRS-MSM</td>
<td>PRS v32</td>
<td>RTCM32</td>
<td>1074(1), 1084(1), 1094(1), 1005(10), 1007(30), 1032(10), 1033(60)</td>
<td>L1 L2</td>
<td>GPS+GLO+GAL+BDS</td>
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<td>ALB</td>
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<td>VRS_RTCM_2.3</td>
<td>PRS v2.3</td>
<td>RTCM2.3</td>
<td>1(1), 3(17), 14(60), 16(300), 18(1), 19(1), 22(10), 23(10), 24(10)</td>
<td>L1 L2</td>
<td>GPS+GLO</td>
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</tbody>
</table>

**Streams**
Next steps regarding Geodetic Reference Frame

- **Sustainable maintenance** service of ALBCORS until 2024;
- **ALBCORS Management Development and Technical Development**
- Realization of one EPN point for the territory of Albania;
- Find solutions with neighborhood countries for a common reference frame;
- Cover all Albania with **gravity measurements** (are expected **1.2M €** of investments);
- Determine the precise **Geoid model** of Albanian territory;
- Number of benchmarks shall be kept minimum enough to maintain the height system (**accuracy check and validation purposes only**);
- Shift the **vertical datum from leveling-based to geoid-based** one in order to realize a more sustainable, **and up to date vertical reference frame** & develop the “**Smart Surveying**” technique based on GNSS & precise Geoid model;
- The over-all objective in the strategy is to make decision makers aware of the advantages of using a modern technology for geospatial data capture.
THANK YOU FOR YOUR ATTENTION!

CORS SYSTEMS INFRASTRUCTURE SECTOR

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