

# **Establishment of MOLDPOS-a Continuosly Operating Reference Stations Network for Moldova**

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**Key words:** GPS, positioning, geodesy, network

## **SUMMARY**

The Land Reform in Moldova started soon after the country became independent from the Soviet Union in 1991. In March 1999, a new National Coordinate System MOLDREF 99 based on the ETRS89 / ITRS97 and UTM projection, with customised zone parameters, replaced the original Soviet coordinate system SK-42. Further on, ALRC has established the connection of the National Geodetic Network with the European Geodetic Frame EUREF.

The legal framework consists of the Strategy of National Development of Moldova 2008-2011, the National Program Moldova-UE, the Law on Geodesy and Cartography and the resolutions of the Government on establishment of the National Geodetic Network and accession of the territory of Moldova to the Global Geodetic System WGS-84 of 31 March 1999.

In 2007 the Agency, in collaboration with Bundesamt für Kartographie und Geodäsie (BKG) , EUREF and EuroGeographics, has installed and jointly operate the first GNSS permanent station IGEO in Chisinau. This reference station is integrated into the EUREF Permanent Network (EPN) and the International GNSS Service array (IGN).

In 2009 the Norwegian Ministry of Foreign Affairs, on behalf of the Norwegian Government, has allocated a technical support for the Project "Capacity for satellite based surveying", that contains:

- i) procurement and installation of 10 reference stations and control centre;
- ii) development of a business model for the precise GPS service, including standard contract provisions and payment regulations, to ensure sustainable operation of the service based on cost recovery;
- iv) execute training of ALRC staff and private surveyors in using precise GPS services.

Positioning Infrastructure of Permanent Stations MOLDPOS represent a modality of modernising the National Geodetic Network from the traditional function of supporting surveying and mapping processes, to enabling the monitoring of global process such as those associated with climate change and extending to real time precise positioning services employed in industries such as agriculture through precision farming and land administration. This network records the satellites signals and provides correction data to its customers to allow for position fixing and navigation to an accuracy level of 2 centimeters or less.

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## 1. INTRODUCTION

The Reference Stations Network for Moldova MOLDPOS cover the territory of the country – 33.000 sq. km. with GNSS stations situated 30-60 km from each other. A total number of stations are 10. <http://www.moldpos.md/>

In 2007, Federal Office for Cartography and Geodesy from Germany (BKG) has donated to the Agency for Land Relations and Cadastre of Moldova a Permanent GPS Station IgeoChisinau, which is used like EUREF. Within S.E. INGEOCAD is functioning a Data Processing and Control Center for GPS Permanent Stations.

The primary objectives of MOLDPOS are:

- To provide real-time accurate positioning of the system users at the entire territory of the state.
- To maintain and develop the national underpinning coordinates reference system and associated geodetic infrastructure.
- To provide web-based access to core geodetic data sets, services and information.
- To work closely with International Geodetic, GI and GNSS communities.
- To develop new application areas for high accuracy national positioning services.
- To promote the science of geodesy and positioning and its value to policy makers, the scientific community and wider society.

## 2. MOLDPOS PRODUCT AND SERVICE

Technical characteristic and data transport layers:

<u>Service</u>	<u>Description</u>	<u>Accuracy</u>	<u>Format*</u>	<u>Transport Layer</u>	<u>DGNSS System</u>
MOLDPOS PP	Post processing	5 mm	RINEX	Internet	GPS+GLONASS
MOLDPOS VS	Post processing virtual station	5 mm	RINEX	Internet	GPS+GLONASS
MOLDPOS RT Precise	Real time processing high accuracy	< 2 cm	RTCM 2.x, RTCM 3.x	GSM, GPRS NTRIP	GPS+GLONASS
MOLDPOS RT	Real time processing	0,5-3m	RTCM 2.x, RTCM 3.x	GSM, GPRS NTRIP	GPS+GLONASS

### 3. MOLDBOS INFRASTRUCTURE

Coverage – Current status of the infrastructure: Reference Stations Network for Moldova  
 MOLDBOS has 10 GNSS permanent stations. All of them are located within the country and 7 are planned in the neighboring countries (5 in Romania and 2 in Ukraine). All this countries are EUPOS Members.

The type of the receivers is: Leica - 16 (10 Moldova, 5 Romania, 1 Ukraine). All of them are GPS/GLONASS. National network of 10 GNSS receivers:

- |              |               |
|--------------|---------------|
| i) Cahul     | vi) Causeni   |
| ii) Chisinau | vii) Comrat   |
| iii) Edinet  | viii) Falesti |
| iv) Leova    | ix) Nisporeni |
| v) Soroca    | x) Telenesti  |

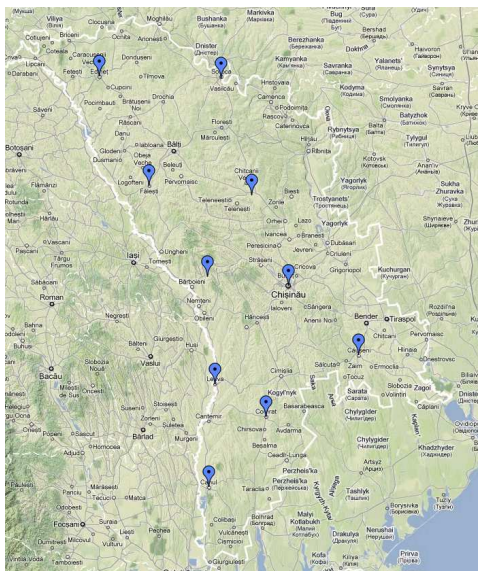


Figure 1: General scheme of MOLDBOS network

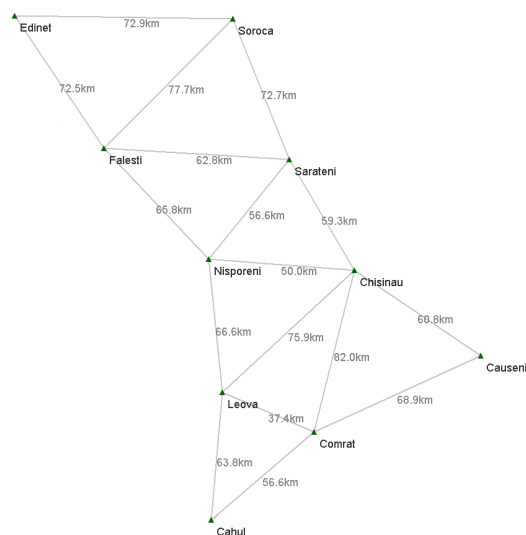


Figure 2: MOLDBOS network design

- Good spacing/70 km
- Similar altitudes
- Good observation conditions

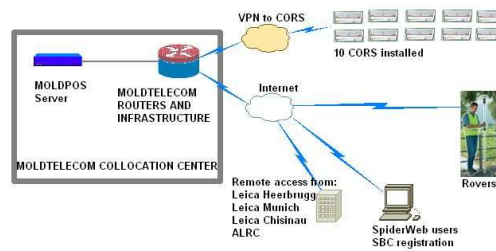


Figure 2: CORS Control Centre

## 4. APPLICATIONS

Satellite positioning-based geo-information applications will become more and more important in several sectors in Moldova, which are relevant for regional development, such as land surveying, land registration/cadastré management, cartography, topography, traffic, transport and fleet management, rescue and safety services etc.

MOLDPOS network work independently from one another. The user works with one of these systems depending on the chosen receiver. The system currently used in most cases is the American GPS. MOLDPOS possible applications:

1. Geodetic surveying (cadastré, topographic mapping, mapping of utilities, Photogrammetry, airborne laser scanning)
2. GIS (decision support system, data bases)
3. Traffic and fleet management
4. Machine guiding
5. Rail transport
6. Water management
7. Emergency services
8. Public transport (bus, trolleybus, tram, taxi)
9. Car navigation
10. Tracking of agricultural goods
11. Tourism (data bases, maps, navigation)
12. Hydrology
13. Fishing
14. Forestry
15. Navigation of private helicopters, planes, boats
16. Disaster management
17. Inventory and real estate evaluation
18. Agriculture application for subsidies
19. Urban planning
20. Height determination
21. Environment protection
22. GNSS-powered sub-terrestrial surveying

The target group includes the following company types:

- Agriculture companies;
- Construction companies, railways, real estate owners/ operators, engineering companies;
- Rescue services, architects, building workers, ecologist, armed forces;
- Cadastré and land properties;

- Building industry, municipalities, authorities;
- Municipalities, regional planners, emergency services, organizations in water economy, insurance companies, fire defense;
- Forest industry, foresters, production planners, administration;
- Sailors, fishermen, lake rescue services, police, salvage services.

MOLDPOS will be the first to offer the combination of efficiency and cost-effectiveness covering the area of the whole country. The company will facing only one partial direct competitor in this field of services. Actually it is a single station CORS solution provider for the town area of Chisinau. The MOLDPOS offered service prices are compatible with his. Probably in the future a second provider will be set up by an instrument manufacturer.

## **5. CROSS BORDER DATA EXCHANGE**

### **5.1. Integration with EPN**

Starting from August 2007 the Agency for Land Relations and Cadastre of Moldova in collaboration with BKG/Germany installed and jointly operates a GNSS permanent tracking station IgeoChisinau.

### **5.2. MOLDPOS –an active member of EUPOS®**

The *EUPOS* initiative promotes the implementation of networks of reference stations in order to make highly reliable and accurate applications possible in several regions. To enforce the interest of the Republic Moldova to be a part of the European partnership in GNSS services, since 23 April 2008 the country is member of the EUPOS initiative. As a part of *EUPOS®* MOLDPOS support precise positioning and navigation with high accuracy - fulfill all accuracy requirements for geodesy and navigation, and guaranteed continuity, availability, and quality of the services.

### **5.3. Cross border data exchange with Romania and Ukraine**

Located in south-eastern Europe, Moldova is bordered on the west by Romania and on the north, south, and east with Ukraine. Most of its territory lies between the area's two main rivers, the Nistru and the Prut. The Nistru forms a small part of Moldova's border with Ukraine in the northeast, but it mainly flows through the eastern part of the country. The Prut River forms Moldova's entire western boundary with Romania. The country's highest point – Peak Balanesti (430 m) is situated in the central western part of the country.

In order to extend the homogeneous coverage of the whole territory of Moldova with the MOLDPOS services, it is agreed with the National Cadastre Agency of Romania to include 6 operational reference stations of ROMPOS into MOLDPOS.

It is also preliminary agreed with the Ukrainian reference network ZAKPOS to include 1 reference station in the future to extend the MOLDPOS service to the border with Ukraine.

## **6. CONCLUSIONS**

To benefit from MOLDPOS in surveying and mapping, Moldova already invested in a terrestrial network of reference stations and a system for tracking the satellite signals, which will also link Moldova to the European GNSS CORS. The MOLDPOS became an active member of the EUPOS.

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