

## THE ACTUAL STAGE OF GEODETIC NETWORKS IN ROMANIA

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**ABSTRACT.** Nowadays, Romania owns a compact network of geodetic triangulation. Review of the available geodetic networks in Romania and their development was made.

### СЪЩЕСТВУВАЩИ ГЕОДЕЗИЧНИ МРЕЖИ В РУМЪНИЯ

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**РЕЗЮМЕ.** Румъния притежава компактна геодезическа триангулационна мрежа. В доклада е направен преглед на наличните геодезическите мрежи в Румъния.

Nowadays, Romania owns a compact network of geodetic triangulation, on four orders, with one 12.000 geodetic points, with the precision of  $\pm 10 - 15$  cm in a bidimensional position and a density of about 1 point at 20 square km. In this frame, the primordial network of 1<sup>st</sup> order was made during 1956 – 1958 on the Krasovski ellipsoid and in 1962 in the Gauss – Kruger projection plan.

These data were done in Moscow, where Romanian specialists were part of; the 2<sup>nd</sup> order network was also made here in 1962.

The 3<sup>rd</sup> and 4<sup>th</sup> orders were made during 1964 – 1969 in Romania.

For the general projection of the state geodetic network during 1958 – 1965 were realized the state surveying networks of the 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> orders, and the surveying network of the 1<sup>st</sup> order was realized on polygons and connection lines with the neighborhood countries Bulgaria, Hungary, Moldavia Republic and Ukraine, during 1956 – 1958.

After 1962, the 1<sup>st</sup> order network was improved with new modern measurements of distances and horizontal angles and also astronomic determinations, made according to the mathematical model during 1975 – 1980 in the frame of the unitary astronomic geodetic network, including to create a PULKOVO – SOFIA – POSTDAM cosmic triangle.

The data that resulted from these workings used as a reference the Krasovski ellipsoid, the fundamental point – The Astronomic Observer from Pulkovo and the normal quotes with fundamental zero at Kronstadt, Baltic Sea.

The geodetic networks of triangulation of surveying from Romania, have connections with similar networks from Moldavia Republic, Ukraine, Hungary and Bulgaria.

Between 1990 and 1991, in the frame of an international collaboration with Bulgaria, it was created the first Doppler national network, shortly named ROMDOP 90 and ROMDOP 91.

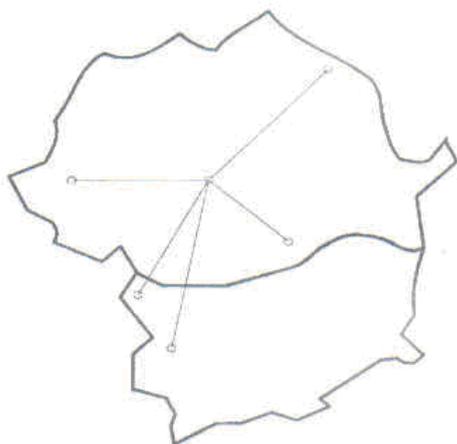


Fig. 1. National Network ROMDOP 91

The first precision connection between the fundamental point of the geodetic state network from Romania, Military Astronomic Observer and the Greenwich Regal Astronomic (Herstmonceux) from Great Britain and the assurance of the

practical possibility of precise recordation of the national geodetic system to the European geodetic system was made, by realization of a national geodetic network (GPS).

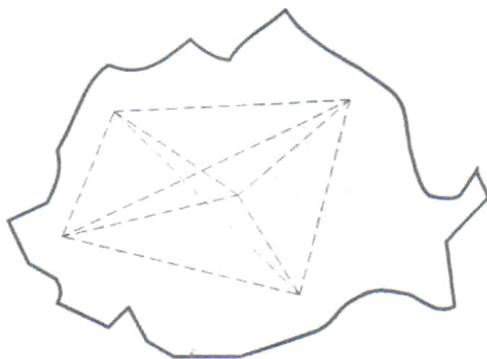


Fig.2. National Network GPS

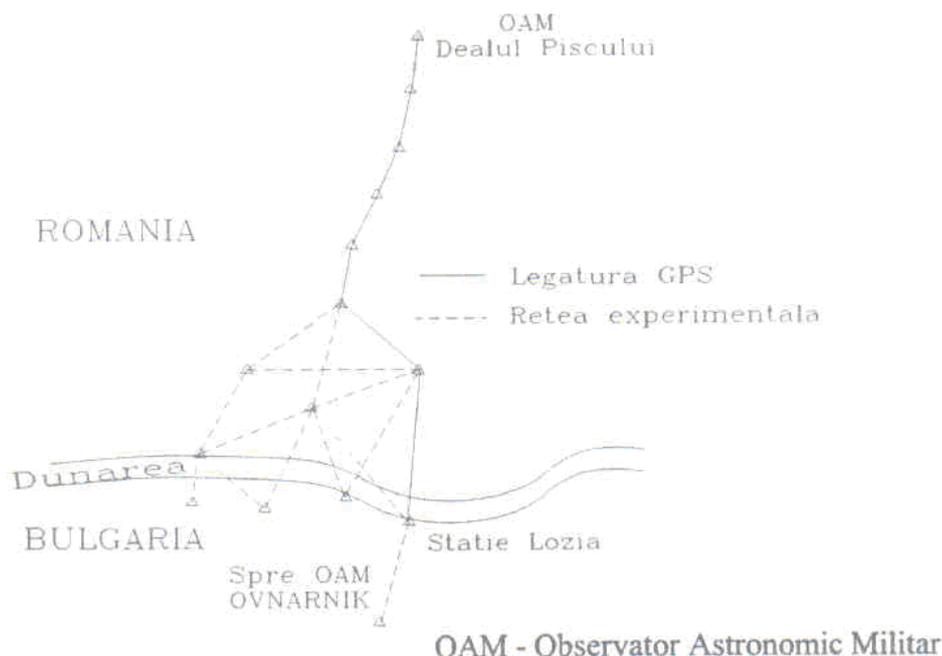


Fig. 3. Realization of the experimental geodetic network on both banks of Danube

In 1992 an experimental geodetic network GPS was realized, which lays on both banks of the Danube river, Romanian and Bulgarian specialists being a part of this big work.

In order to remove the uncertainties in the three-dimensional position, brought about by big distance (over 1000 km) between the astronomic observers from Herstmonceux and Bucharest where firstly made, simultaneous measurements GPS in 5 points: 2

points situated on Romania's territory which are the same with the points from national network GPS and other three points situated in Great Britain (Herstmonceux), Germany (Wetzell) and Sweden (Onsala) geodetically positioned with VLBI (Very Long Baseline Interferometry) equipment and the components of the world wide network of determination of the terrestrial poles' movement, points that have determined an optimal configuration of the GPS effectuated measurements.



Fig. 4. The GPS connection of high precision between the astronomic observers from the Pisco hill and Herstmonceux.

The modern special techniques of precise positioning such as: VLBI, SLR (Satellite Laser Ranging). Tranzit and GPS have the advantage that the first point could be situated at big distances from the positioned point. By "position" it must be understood a pair of three coordinates reported at one or plenty systems of specific and well – defined coordinates.

The path that needs to be followed nowadays, for positioning a geodetic network is by a set of points which's positions in the conventional terrestrial system of coordinates are determined with the help of the observations upon the artificial satellites of Earth. It is actually a transfer technique of the positions in which the reference network defined by the observation points of the satellites is connected by the reference network defined by the permanent pursuit stations which give data to determine the satellite's orbit.

The tendence at the world wide levels is to maintain the reference networks made of reference points which could assure the first base for the new positioning systems.

These networks would be the permanent way of survive the state of the positioning system and the global deformations of the Earth, related to the system of coordinates which was selected.

Considering the geodetic experience on world wide plan and of the countries that have a resemblance as territory with Romania, and the financial possibilities of Romania, it could be said that nowadays, the orientation is pointed through GPS technique.

Choosing the points from the GPS project, it must be considered other things that the one considered are the classical network.

The main role of these is to be used as first points for the GPS measurements of different beneficiaries.

The national GPS network considered from the reference points, could be created easily and cheap so the afterwards to assure the fundament of all GPS measurements effectuated on the country's territory for different purposes.

The classical network with two plus one dimension is still necessary, because all the geodetic equipment (except GPS), work only in this system, and in plenty places the GPS technique cannot be used. The GPS coordinates, which are three-dimensional do not relate with the daily geodetic needs, which usually exist in the planimetric network; the transcalculation not being precise, because it would need the precise knowing of the geoid.

So, until the geoid's date will not be available for Romania's territory with a related precision the actual surveying network is also needed.

## Conclusions

There were introduced few aspects related to the evolution and the actual stage on the problem, regarding the science and the technique that are known and applied in the geodetic field because of:

- in the last half century in Romania, there were preoccupations related to the development of science and technique in the domain of survey, the results being materialized by creating some geodetic structures of good quality at national and regional level;
  - to realize an obvious progress, Romanian specialists contributed, but also from outside the country, mainly from the neighborhood countries;
  - the contribution of specialists from Bulgaria was seen through permanence and substance, being proved nowadays as a main factor of universal progress;
  - the progress obtained in the geodetic domain is transposed in the fields that benefit of it, in which the miner field;
- as common beneficiaries of survey, the specialists from our institutions could and should participate in common at the scientific and technique progress in the domain of miner survey.

## References

- [1] Dima, N. – Geodezie. Editura Universitas, Petrosani, 2006.
- [2] Grecea, C. – Introducere in geodezia satelitara. Editura Timisoara, 2000.
- [3] Neuner, I. – Sisteme de pozitionare globala. Editura Matrix, 2000.

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