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# Coordinate Systems used in Satellite Technology

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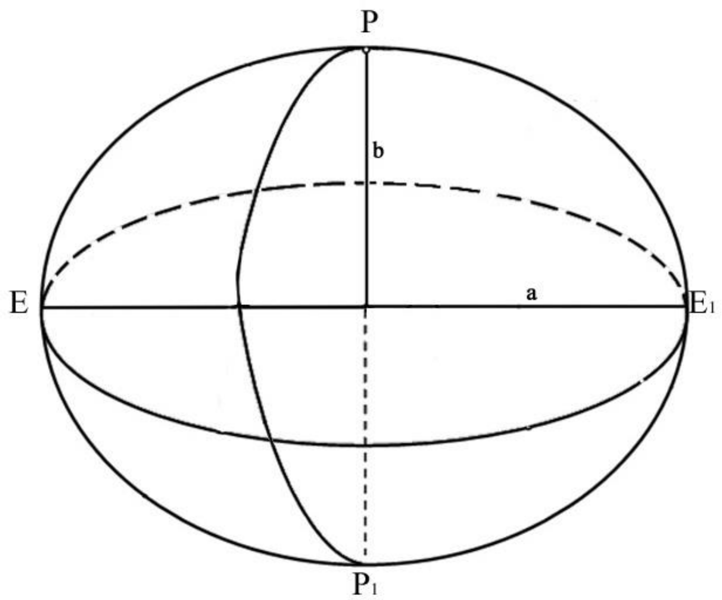
**Annotation:** Quantities and participants in the optimal efficiency of the transfer from the coordinate transmission to the global satellite system (GSYT) from stable satellite technologies.

**Key words:** Satellite, meteorological measurements, highway, geodetic receivers, modern technology, modern equipment. State geodetic networks, topographic map, electronic taximeter.

**Introduction.** Due to the fact that the local coordinate system is not developed on the basis of uniform rules and requirements throughout the country, today there are problems in combining the results of surveying for cadastral purposes, ie combining plans for neighboring areas to create integrated maps. To this end, there is a need to develop MCTs for cadastral entities in the regions, and therefore to focus on satellite coordinate systems and their application in cadastral work. It details the coordinate systems used in satellite technology, the location of boundary points of the cadastral object with the help of satellite geodetic receivers, the reshaping of coordinate systems, and the use of software products in the calculation of coordinates from one to another. Illuminated.

Scientific and technological advances in recent decades have led to the development of a fundamentally new method for determining the coordinates of points - the determination of distances to satellites. Nowadays, this method has a number of undoubted advantages - high accuracy, independence from the weather, the absence of the need to have a direct view between adjacent points, etc. has been widely acclaimed and widely used.



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The main part. The parameters of the common ellipsoid have long been mathematically determined by many geodetic measurements made on the earth's surface. By the 1980s, the results of terrestrial and sea satellites at sea and ocean level had been developed and the values of the total terrestrial ellipsoid parameters. — large half-axis a and compression coefficient a — had been recalculated. This work was first performed in the United States on the basis of parameters called the common earth ellipsoid WGS-84 Later, as a result of work in Russia, the parameters of the common earth ellipsoid were redefined and renamed the PL-90 ellipsoid. Both of these ellipsoids are very close to each other. This can be seen in the following.

***Figure 1. Umumer ellipsoid and its parameters.***

***Table 1***

| Parameters | PZ-90 | WGS-84 |
|---|---|---|
| Large half arrow a, m | 6378136 | 6378137 |
| Compression coefficient a | 1:298,257839 | 1:298,257234 |

The following systems are used to locate surface objects:

- right-angled spatial coordinates;
- geodetic coordinates;
- flat rectangular geodetic coordinates;
- normal heights.

These coordinate systems are connected by a common earth ellipsoid PZ (Earth parameters) In a rectangular spatial coordinate system, the center O of the common earth ellipsoid, which connects the center of mass of the Earth to the origin, is assumed. The geodetic coordinate system belongs to the common earth ellipsoid, the center of which is connected to the center of mass of the Earth. The meridians and parallels serve as the principal lines of the common earth ellipsoid.

The PZ-90 coordinate system is a geocentric rectangular space system with the beginning of the Earth's center of mass. The PZ-90 coordinate system is connected to the points of 33 Space Geodetic Networks on Earth. The geodetic date includes the geodetic latitude and longitude of the starting point on the Krasovsky ellipsoid, the geodetic azimuth of the starting direction, the composition of the vertical line deviation, and the quasi-geoid height above the Krasovsky ellipsoid at the starting point.

Because GPS is a geodetic and navigational tool, surveyors and navigators need to know how GPS coordinates relate to standard geodetic coordinate systems.

The main reason why GPS measurements make errors in motion is because of the misunderstanding of the connections.

When you look at the Earth from space, it is clear that its surface is not the same, but it is practically uneven.

Because GPS serves to determine the coordinates of any point on the earth's surface, it uses an elliptical surface-based geodetic coordinate system.

In practice, various ellipsoids or mathematically identifiable surfaces (similar to the Earth's surface) are common.

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The ellipsoid used in the GPS system is called the WGS-84 or 1984 Universal Geodetic System. The position of a point on the earth's surface (note that this is not an ellipsoidal surface) is determined by its latitude, longitude, and ellipsoidal height.

An alternative method for determining the position of a point is the Cartesian (rectangular) system, in which the coordinates are represented by sections taken from the center and axes of the accepted head or spheroid.

This method is used to determine the spatial position of a point using GPS.

The motion of Earth's satellites is represented by a rectangular inertial geocentric coordinate system.

In the current satellite navigation system, the initial coordinates are determined in the general geocentric coordinate system. NAVSTAR uses WGS-84 as the general coordinate system of GPS navigation, and P3 (Earth parameters) - 90 in the GLONASS system.

The WGS-84 is built on the same principle as the PZ-90. However, there is some difference between them: the coordinates do not coincide with the starting points (O1 and O2) and the coordinate axes are rotated relative to each other, as shown in *Figure 2.*

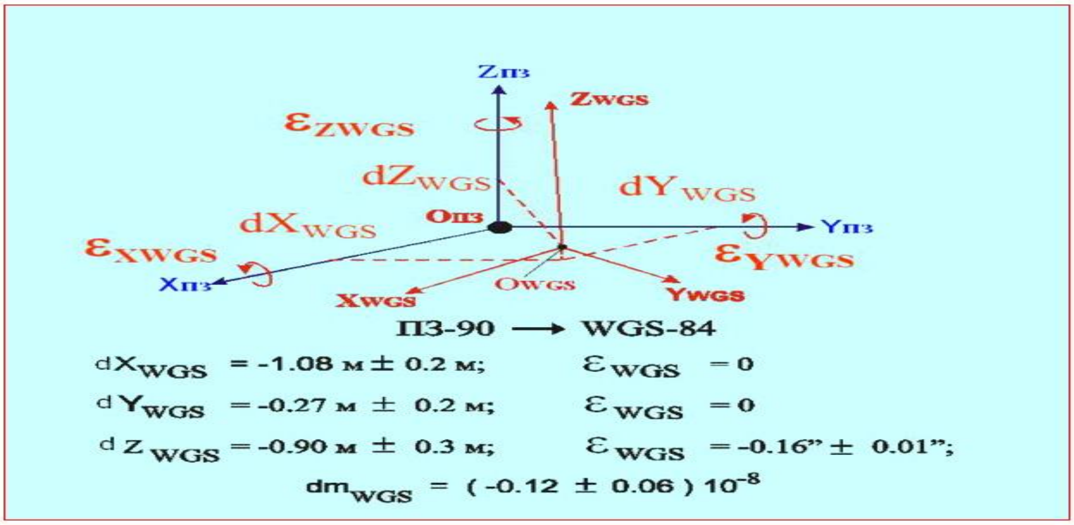


***Figure 2. Correlation parameters of coordinates PZ-90 and WGS-84***

The heads of two rectangular spatial coordinate systems are moved along the coordinate axes relative to each other at values X_0, Y_0 and Z_0. In this case, the coordinate axis of the first system is rotated at angles ōx, ōy, ō with respect to the second. The linear scales of the systems may also vary. The above-mentioned X_0, Y_0 and Z_0, ōx, ōy, ōz and scale coefficients are called transformation elements. The values of these elements between the PZ-90 and WGS-84 systems are given:

***Table 2***

| Parameters r | $X_0$, m | $Y_0$, m | $Z_0$,m | ωx,s | ωy, s | ωz, s | m |
|---|---|---|---|---|---|---|---|
| Values | -1.08±0.2 | -0.27±0.2 | -0.9±0.3 | 0 | 0 | -0.16±0.01 | $(-0.12\pm0.6)10^{-6}$ |

EPS allows you to find coordinates in real time with an accuracy of 1-3 m. At base stations, the distance to GPS satellites is constantly measured and coded differential corrections are calculated, which allow users to receive in real time using small-sized auxiliary devices. Field of application:

- vehicle navigation;
- traffic control system;
- fleet management;
- public security services;
- agriculture and forestry;
- environmental protection;
- Geographic Information Systems (GIS).

HEPS provides positioning in real time with an accuracy of 1-5 cm. In addition to coded corrections, phase corrections are also given, which serve to increase the accuracy of coordinate finding. Field of application:

- in geodesy, topography, cadastre and construction;
- aerial photography;
- Geographic Information Systems (GIS);
- fleet management;
- public security services;

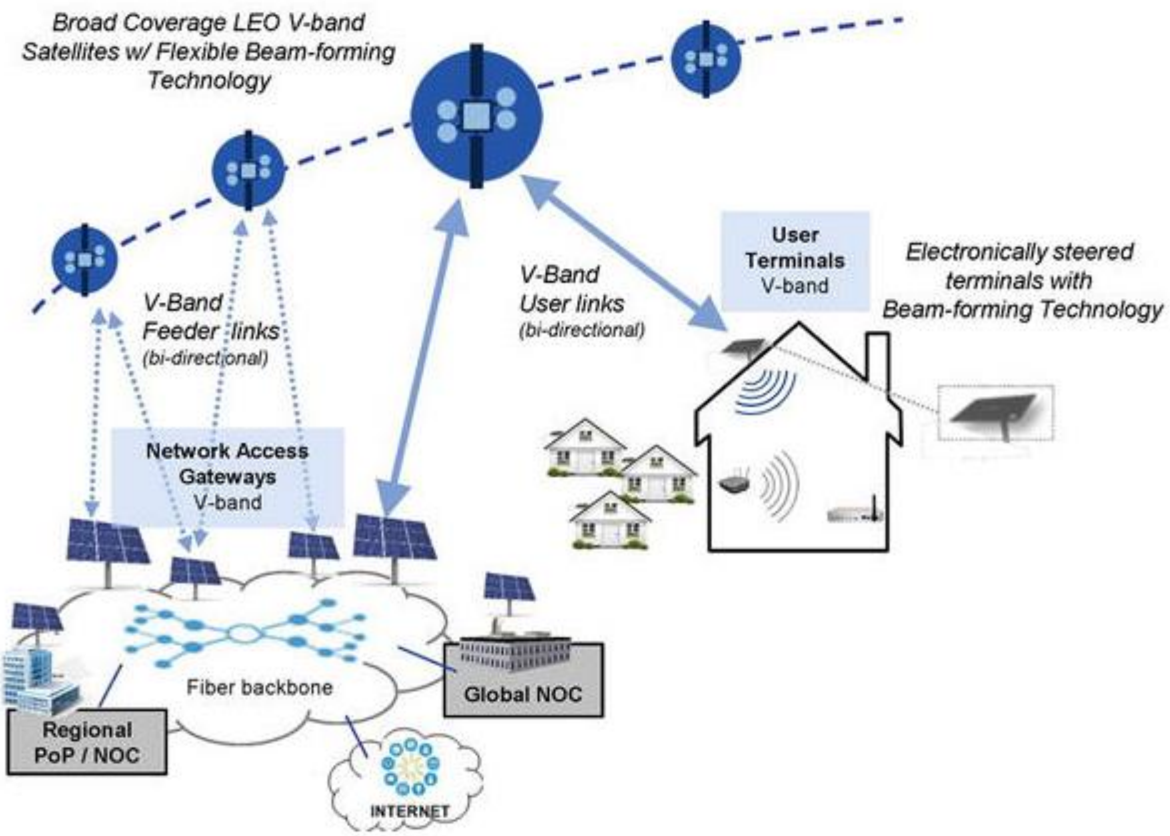


*Figure 3. Operation of the satellite navigation system.*

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GPPS provides 1 cm accuracy and allows you to get coordinates online. To find the coordinates, it is enough to make measurements on a single receiver. Field of application:

- high-precision geodetic works;
- cadastral surveys;
- aerial photography;
- engineering surveys.

The main differences between the cadastral system introduced in the United States and the cadastral system adopted in other countries are:

- Legal description of existing lands in the country, their boundaries, description of land plots is carried out on the basis of the state system of geodetic coordinates;
- the market value of each real estate, when, where, by whom it was valued, by whom, for how much, the rental price;
- information on where and how much real estate is subject to property taxation, information on taxpayers, their address, amount of tax;
- description of land plots, presence of other buildings or structures in them, natural descriptions, location of property, bar and if the land is intended for agriculture, productivity in several years, if it is a building or structure, then all information about construction, level of demolition, etc. . all work is done on high-level computers;

**Conclusion.**

1. Installation of MKT should be carried out by means of analytical geometry methods or cartographic modifications. These include orthogonal and conformal modifications, WGS-84, SK-42 design modifications, and other methods.

2. The established MKT is a personal and effective requirement, ie it should be possible to pass from the MKT with the help of YADKT gakalits ”. You can get the following values for the following key parameters: the coordinates of the head of the MKT in a single state coordinate system; coordinates of the head of MKT in the departmental coordinate system; The distance of the meridian passing through the MKT; The location of the MKT axes at the head of the MKT; management system; the difference in the scales of the coordinate systems.

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