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"Global Navigation Satellite Systems: Armenian Experience"

Hambardzumyam Vardges

Geodesy and mapping centre, SNCO under the State Commitee of the Real Property Cadastre of the Government of the Republic of Armenia

35/2 Komitas ave. 0051 Yerevan,
Republic of Armenia
Tel (Mobile) +37494174004
FAX (Office) +37410325449
Mail. Vardges_1986@mail.ru
Website www.armgeokart.am

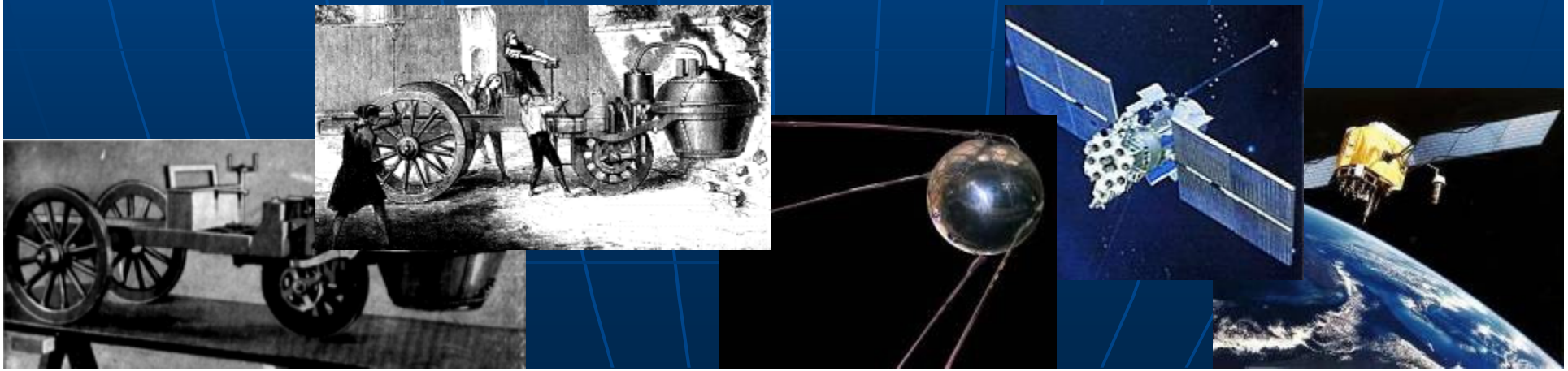
THE STATE COMMITTEE OF THE REAL PROPERTY CADASTRE OF THE GOVERNMENT OF THE REPUBLIC OF ARMENIA

"Centre of Geodesy and Cartography" SNCO

The Dawn of the Space Age and not only

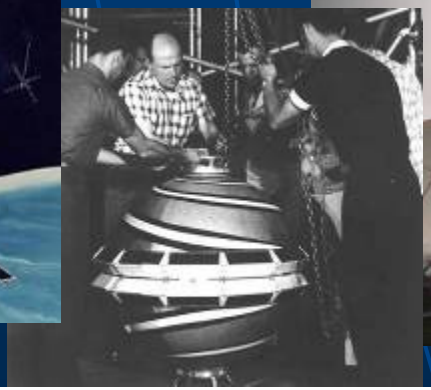
In 1769, the very first self-propelled road vehicle was a military tractor invented by French engineer and mechanic, Nicolas Joseph Cugnot (1725 - 1804). It was used by the French Army to haul artillery at a whopping speed of 2 1/2 mph on only three wheels. The first known automobile accident was in 1771, the second vehicle is said to have gone out of control and knocked down part of the Arsenal wall.

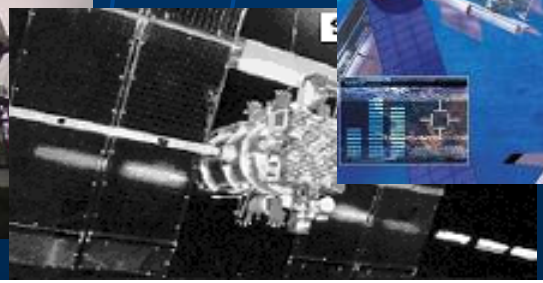
History changed on October 4, 1957, when the Soviet Union successfully launched Sputnik I. The world's first artificial satellite was about the size of a beach ball (58 cm.or 22.8 inches in diameter), weighed only 83.6 kg. or 183.9 pounds, and took about 98 minutes to orbit the Earth on its elliptical path.



The first satellite navigation system was Transit, a system deployed by the US military in the 1960s. Transit's operation was based on the Doppler effect: the satellites traveled on well-known paths and broadcast their signals on a well known frequency.

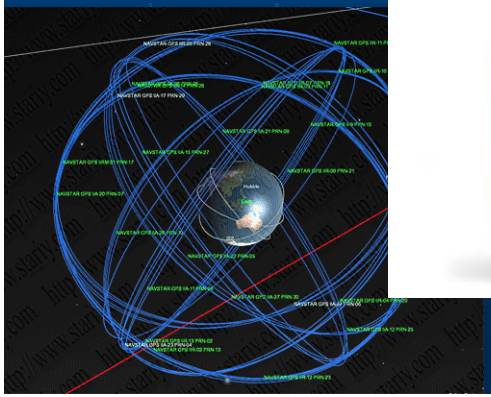
The launching of the first ever artificial earth satellite gave a strong impetus to the development of satellite navigation capabilities. The 80s of the last century saw the emergence of satellite navigation systems which were conceived primarily to serve military user requirements. In recent years Global Navigation Satellite Systems (GNSS) are becoming more and more common and are widely used in civil applications. Currently, there are several such systems in place worldwide at varying stages of development.

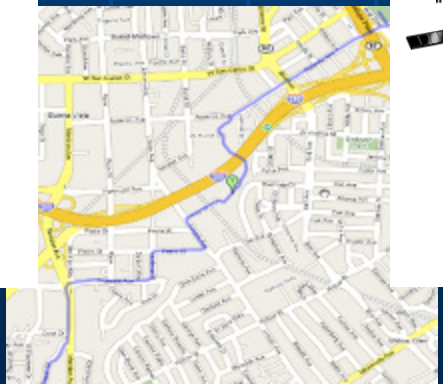



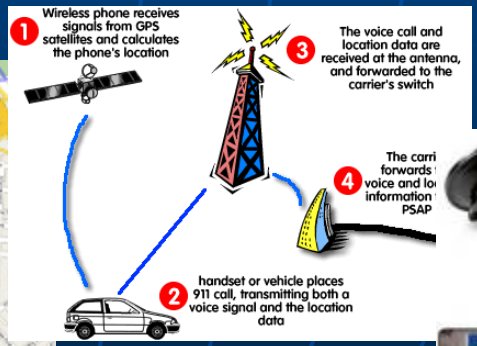



Today, hundreds of millions of people worldwide rely on satellite navigation to deliver accurate position and time information to a host of critical services, including everything from guiding aircraft at night and during inclement weather to synchronization of cellular communication networks. Other applications range from helping emergency dispatchers direct rescue personnel to giving route instructions to touring motorists.

As these and other GNSS-enabled applications become increasingly woven into the fabric of our global 21st-century economic and social infrastructure, the consequences of breach-of-service become greater as well. In this context, service breach encompasses not only system outages (e.g., constellation failures, inadvertent or deliberate interference, and so forth) but also failures of trust in the basic integrity of the position and time broadcast.



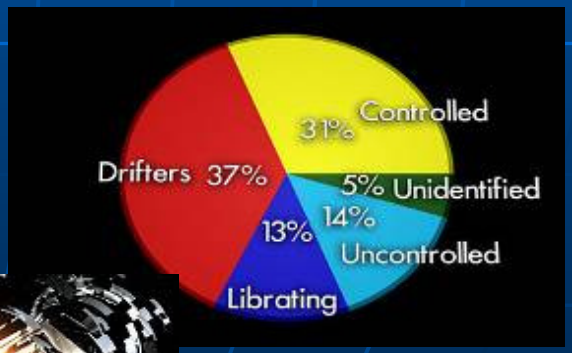




From the launch of Sputnik-1 on 4 October 1957, approximately 4600 launches have placed some 6000 satellites into orbit, of which about 400 are travelling beyond geostationary orbit or on interplanetary trajectories.

Apparently the number of objects orbiting the planet is increasing by two hundred per year on average. The vast majority of these objects in orbit are satellites, which remain in orbit around the Earth once their lifespan is complete.

Today there is no international treaty mandating behavior to minimize space debris.



The State Real Property Cadastre Committee

The State Real Property Cadastre Committee is the main agency on national level. The tasks of State Real Property Committee are to create legislative, organizational and property registration activities, to provide information sharing and integrate all kinds of real estate data into one system for establishing an effective land policy, also works in geodesy, cartography and navigation areas.

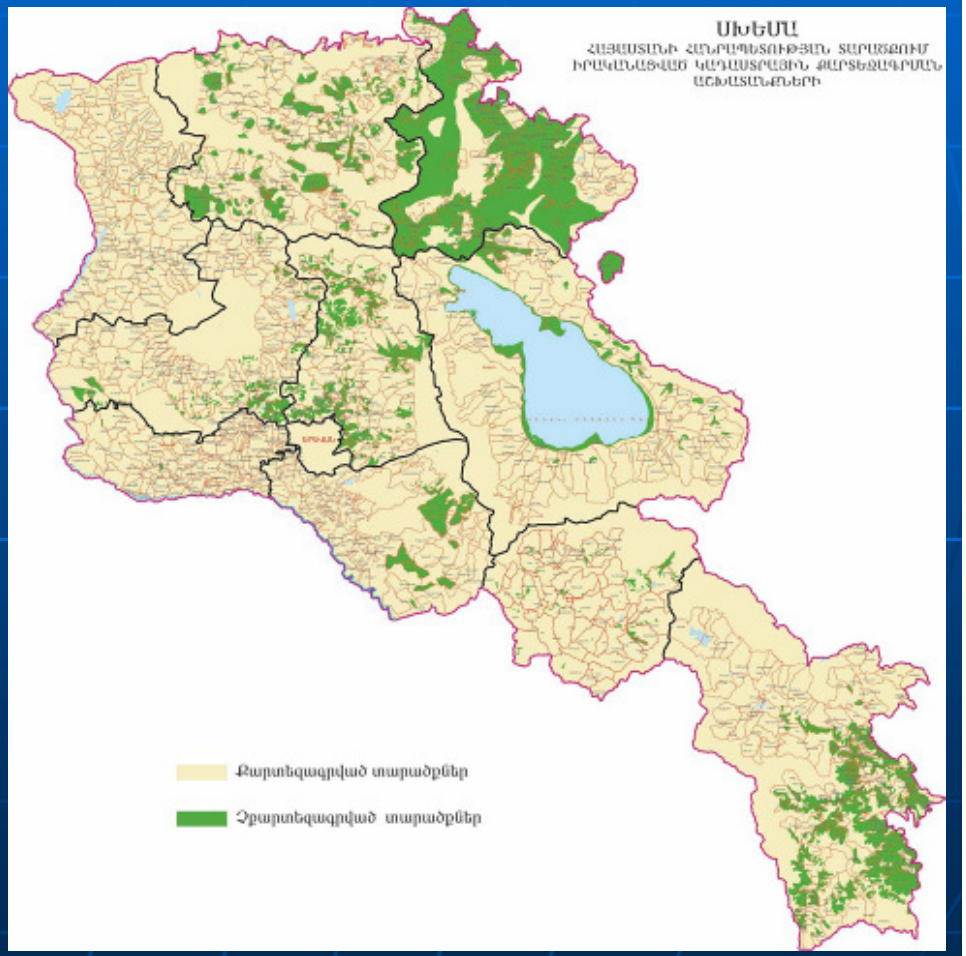
Organization is set up in 1973 by the central board of geodesy and cartography of the Council of Ministry of the USSR, which accomplished development of the geodetic network and topographical maps or creating plans' procedure in the territory of the RA.

In September 2000, by the resolution of the government of the RA, the organization was transferred from the Ministry of Urban Development to the State Committee of the Real Property Cadastre of the Government of the Republic of Armenia as a "Centre of Geodesy and Cartography" CJSC, and since November of 2003 it was renamed as a "Centre of Geodesy and Cartography" SNCO.

On the territory of Armenia during 1998 and 2005, cadastral mapping work was done to implement a system of state registration of property rights.

Cartographic works were been performed using modern geodetic equipments: electronic tachometers and satellite survey stations with GPS system.

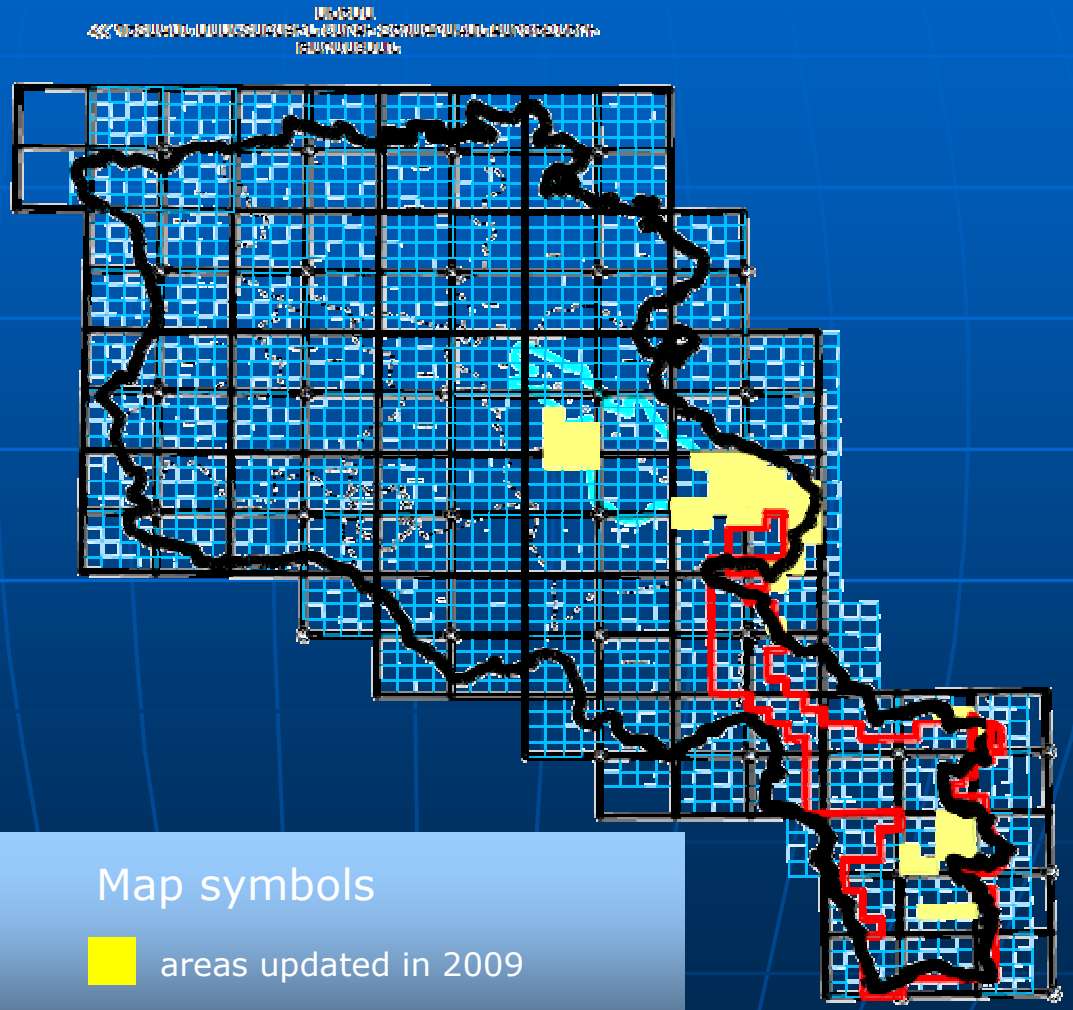
Creation of cadastral digital maps has been fulfilled settlements with the scale of 1 : 500, privatised territories 1 : 2000 and administrative territories of communities 1 : 5000 and 1 : 10 000 scales.



During 2002 and 2007 has been fulfilled and finished creation of 1: 500 - 1 : 1 000 000 scale topographical maps from the series of RA state scale

Scales	Total count of sheets	Digital maps	
		sheet	%
1:1 000 000	2	2	100
1:500 000	4	4	100
1:200 000	11	11	100
1:100 000	34	34	100
1:50 000	107	107	100
1:25 000	368	368	100
1:10 000	1341	1341	100
Total	1867	1867	100

Since 2009, work began on updating topographic maps of the number of state scale RA.



Map symbols

areas updated in 2009

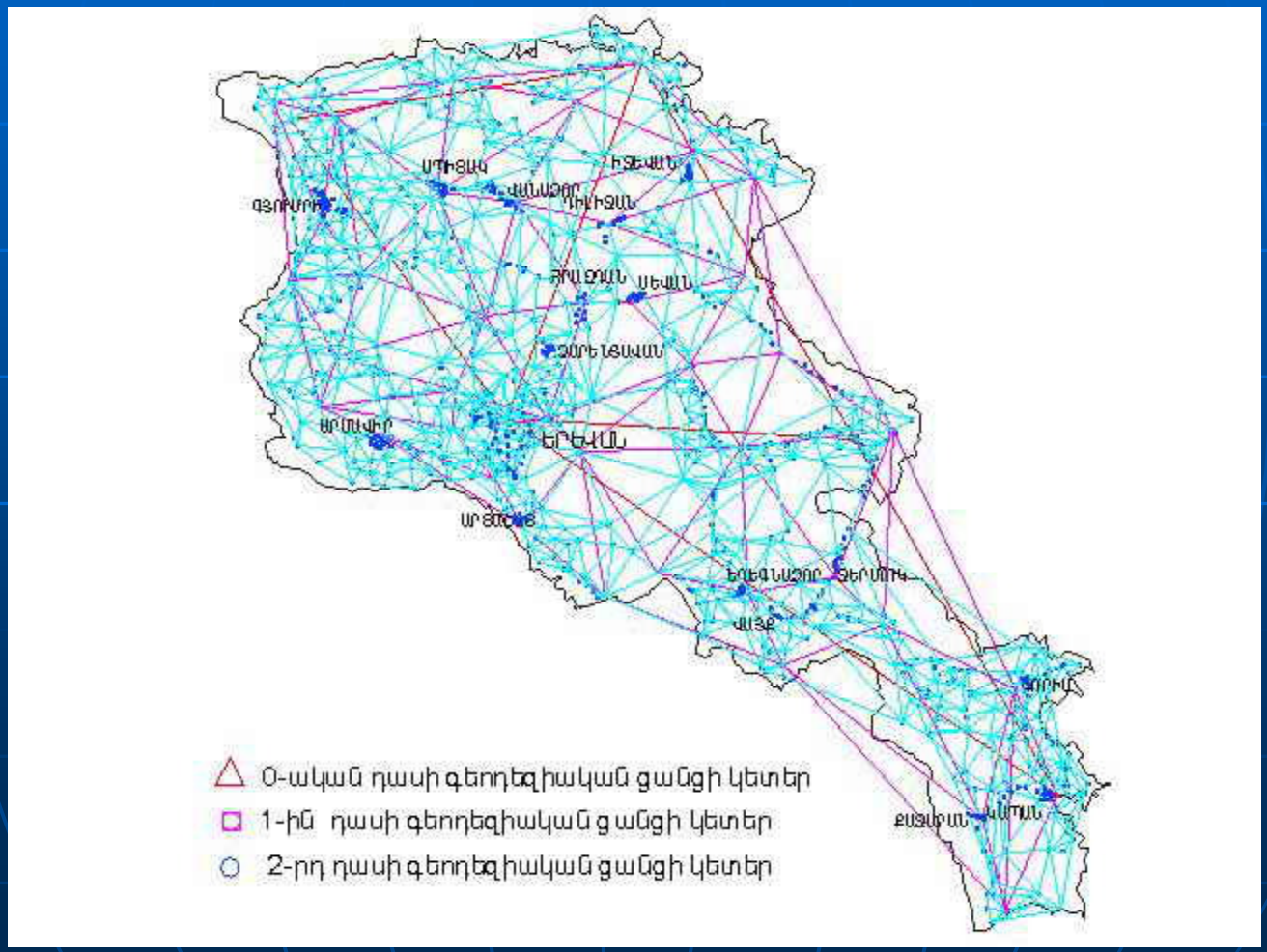
areas planed to update in 2010

In recent years, Geodesy experiencing great progress. In the production are implemented new digital levels, photogrammetric stations, electronic tachometers and Global Navigation Satellite Systems receivers. The use of new digital technologies, the availability of software packages has greatly increased the accuracy of geodetic measurements, as well as productivity.

In March 11, 2002 by the decision N 225 of RA Government since 2002 on the territory of the RA has been introduced the world coordinate system WGS-84.

Implementation of satellite technology in surveying dramatically changed the organizational and technical principles for the implementation of field and camera work.

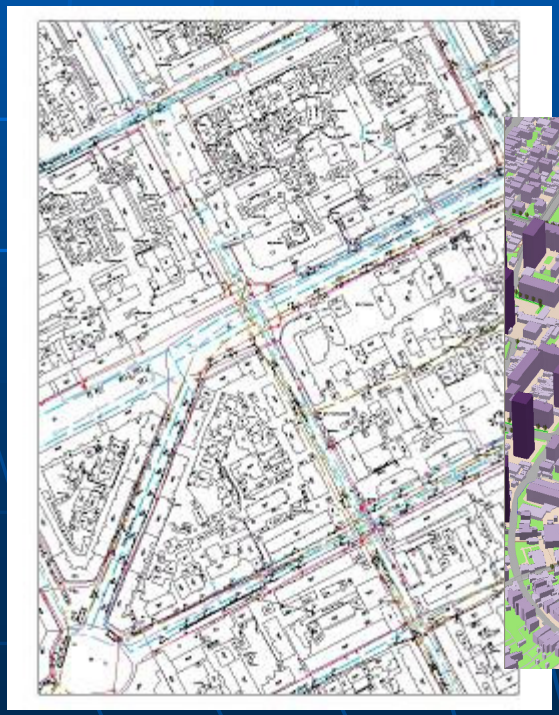
Scheme of a geodetic network in the Republic of Armenia in the world coordinate system WGS-84 on GPS satellite technology.

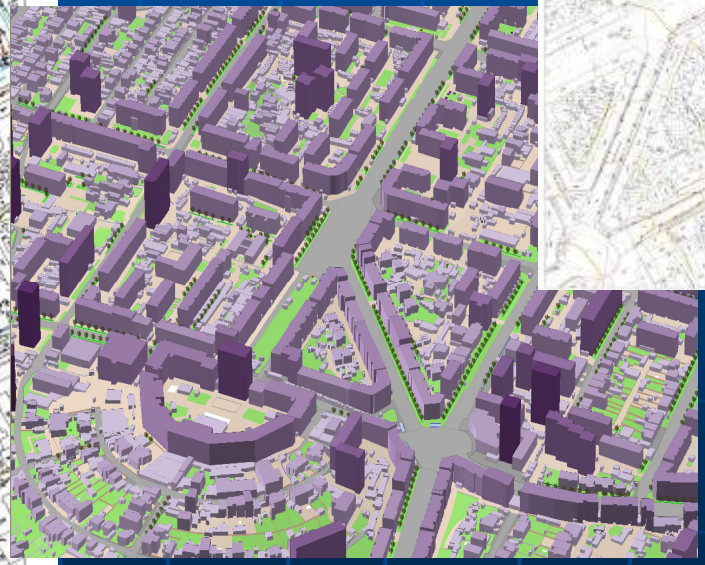


In "Centre of Geodesy and Cartography" SNCO, which belong to the State Committee of the Real Property Cadastre of the Government of the Republic of Armenia, have establish the station. Then performed an experimental operation as well as preliminary training.

Personal ground stations help us to receive, store and process Earth observation images from the Space.

To create a basic GIS system of the communities in 2005-2008 years works were carried out in several localities of the RA (including Ashtarak, Tsakhkadzor, Byureghavan) and in the administrative districts of Yerevan (Arabkir, Davtashen, Kanaker-Zeytun, Avan, Nor Nork, Achapnyak, Nork-Marash Malatia-Sebastia, Nubarashen, Erebuni).





In December 17, 2009 at a meeting of government of the RA was approved the law of the introduction of the navigation systems and the establishment the network of a Continuously Operating GPS Reference Stations in the RA.

In 2010, it is planned to develop and submit for approval by the Government of the RA program implementation of navigation systems and the establishment the network of a Continuously Operating GPS Reference Stations in the RA.

Solution of many problems depending on the positioning of objects and implementation of monitoring, today in different sectors of the economy have become daily works.

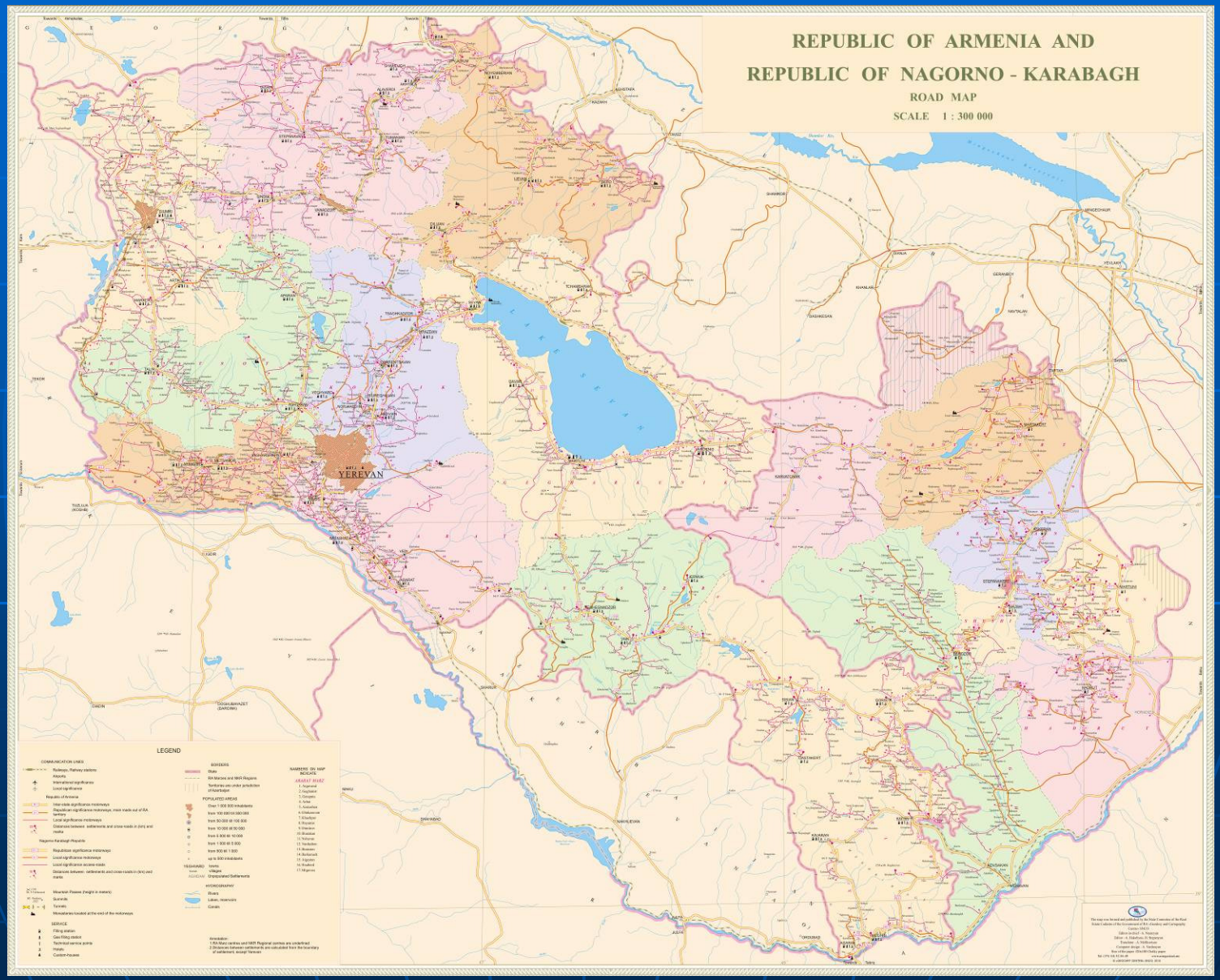
Currently, the modern Global Navigation Satellite Systems provide economic and industrial development of the country, strengthen its defense and national security, promote development of science and high technology.

Road network of the Republic of Armenia

Today, the total length of road network in the Republic of Armenia is about 7700 km (not including 2700 km of urban roads). Public roads of state significance on the functional values are divided as follows.

- Roads having interstate significance - 1561km.
- Republic roads - 1800 km.
- Local roads - 4342 km.

Road network map of the Republic of Armenia

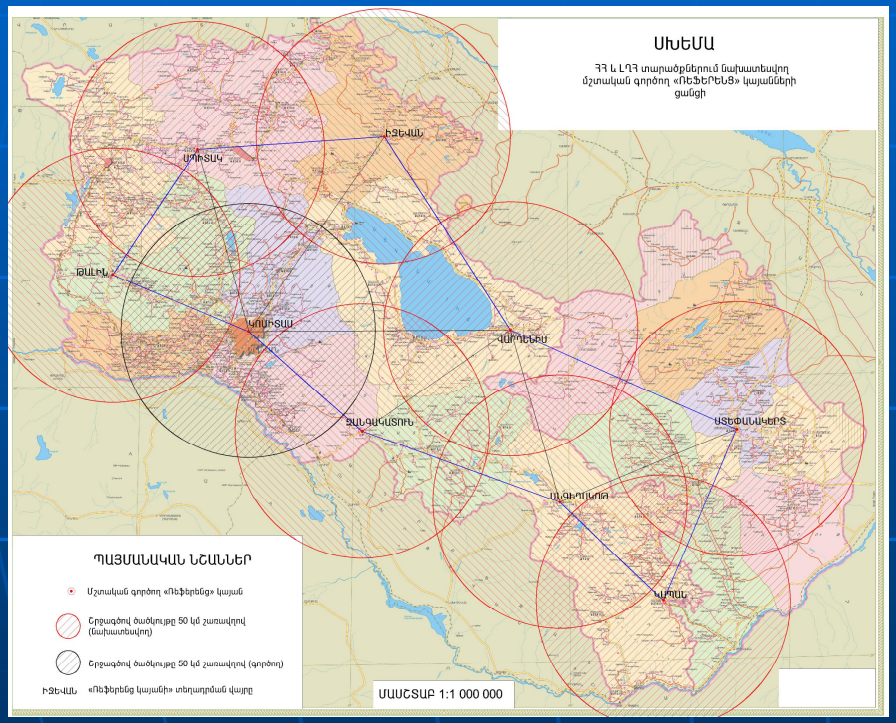


IN THE REPUBLIC OF ARMENIA THE PROCESS OF HANDLING A NAVIGATION SYSTEM HAS TWO DIRECTIONS

GNSS REFERENCE STATION SYSTEM

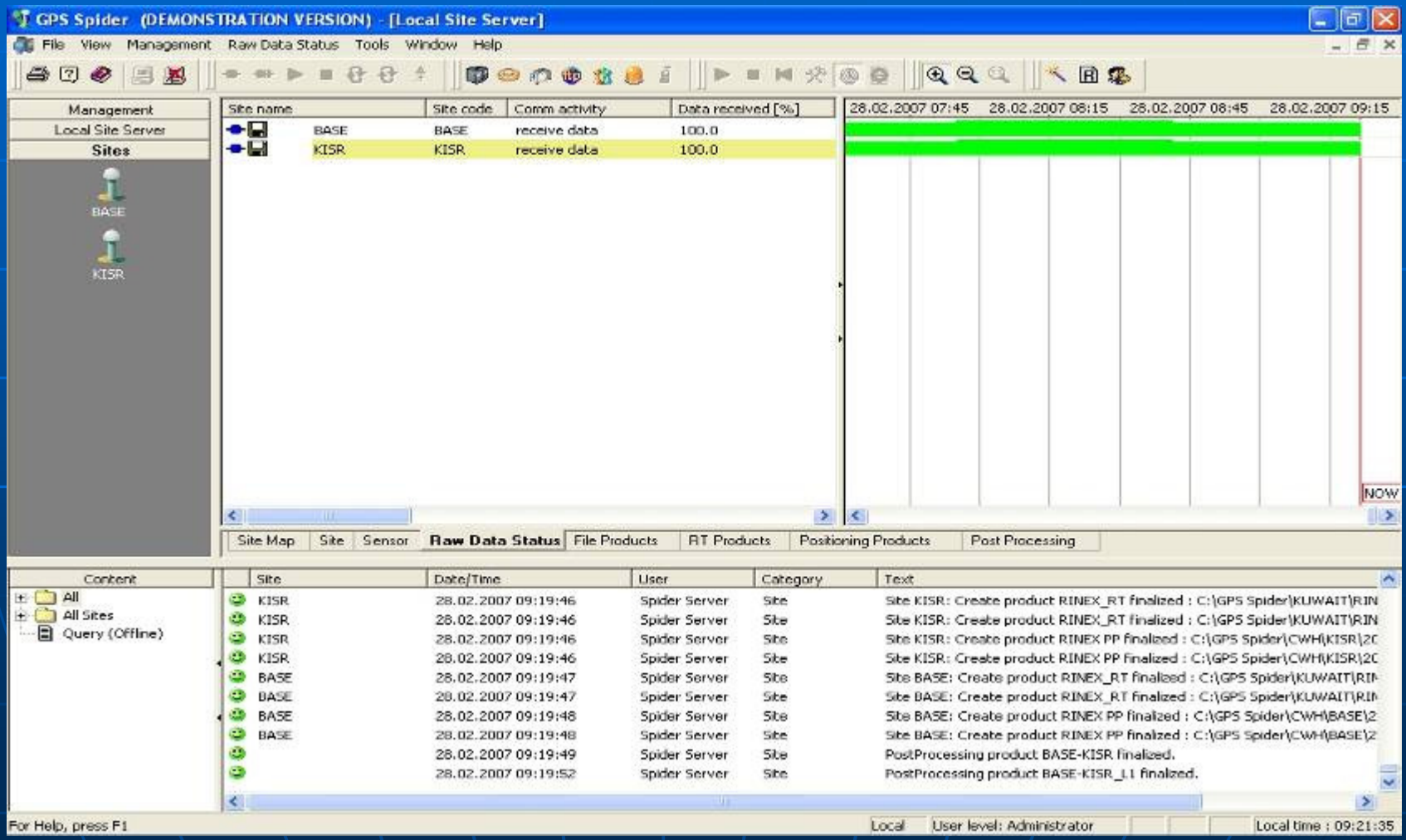
CONTROL SYSTEM OF VEHICLES

The trend of development of GPS reference stations in the Republic of Armenia



Support of full coverage of the RA will be fulfilled by the network of 9 GPS reference stations(with 50 km radius)

GPS Spider software
LOCAL SERVER



The principle of Global Navigation Satellite System

GPS/ ГЛОНАСС

RECIEVER

Through the transfered signals of satellites is desided
- **location**
- **speed**
- **direction**

CONTROL CENTER

GSM/GPRS

1. **Receiving and saving data**
2. **Statistic data registration and passing**
3. **Map creation**
4. **Routing**

The activities of the navigation system in the Armenia carried out automatically in real time on the following basic principles:

- Creating navigation maps
- Routing
- Implementation of monitoring
- System control




CREATION OF NAVIGATION MAPS

Currently, the need for equipment navigation systems has increased dramatically, in this sense Armenia is no exception, and for it is needed to have high-quality navigation maps, which will be used in navigation systems.

In the RA there are number of private enterprises engaged in the development of navigation systems that do not create maps of high accuracy.

Navigation maps prepared for the introduction of the navigation system in the Republic of Armenia will be established based on the RA state series from 1:10000 till 1:100 000 scale for topographical maps and from 1:500 till 1:5 000 scale for GIS and cadastral maps.

BASES OF NAVIGATION MAPS

For the mapping of the navigation system of the RA are used the following layers existing in GIS and topographic maps.

- **Boundaries**
- **Buildings and constructions**
- **Railroads**
- **Network of roads**
- **Road constructions**
- **Hydrography**
- **Land and territories**

Base of navigation data will be updated on the basis of information provided by the relevant authorities.

Navigation maps will be periodically updated in the prescribed manner.

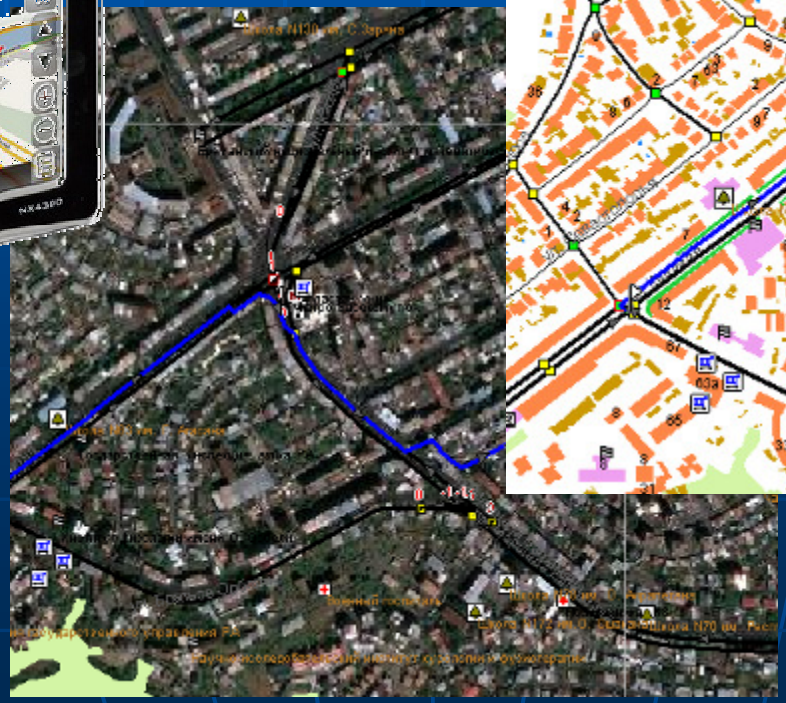
Navigation maps should be provided for open use and contain the necessary information for the navigation system, which should be emphasized more information about the roads and elements of roads service (service stations, petrol, parking lots, shopping centers, restaurants, hotels, etc.).

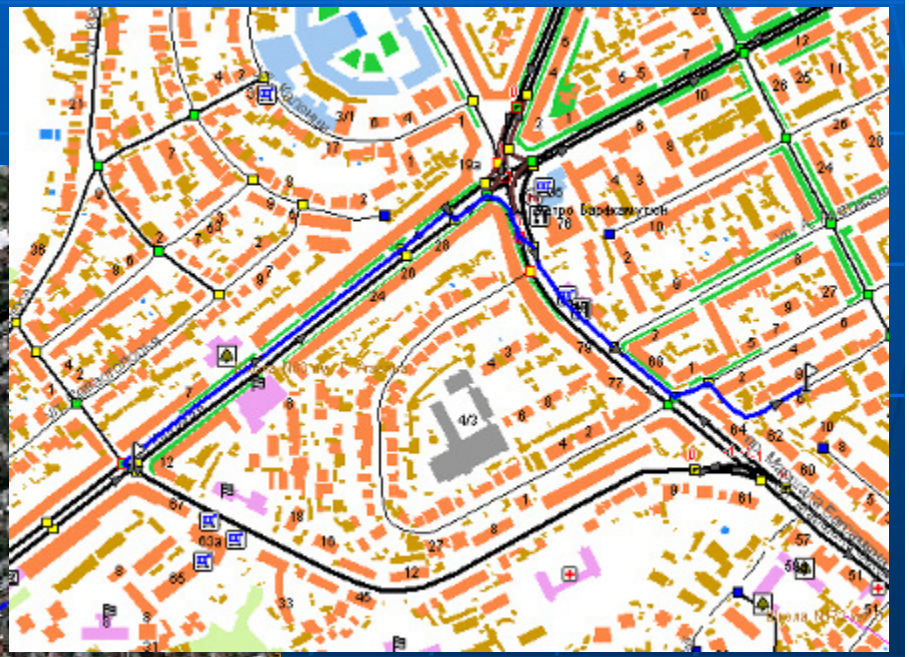
PART OF NAVIGATION MAP
FOR ARABKIR ADMINISTRATIVE DISTRICT

GPSMapEdit software

ROUTING

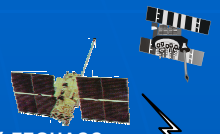
In the navigation system routing works were carried out by means of equipments based on satellite technologies





SYSTEM OF TRANSPORTATION MONITORING IN THE REPUBLIC OF ARMENIA

PERSPECTIVE SCHEME



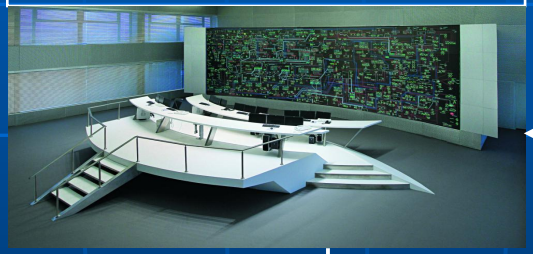
GPS/ ГЛОНАСС navigation satellites

INFORMATION MONITOR

Municipal transport

Vehicle monitoring center

INTERNET



WEB-access

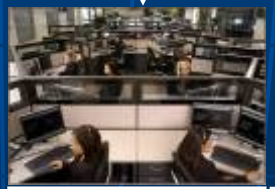
GPRS base station of the GSM network

SMS center of the GSM network

Ministry of Emergency Situations

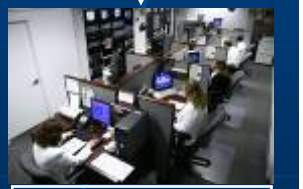
Republic of Armenia Police

Ministry of Defense



Other governmental bodies

Transportation agencies



First aid service

Expected economic result of the introduction of satellite navigation system in the RA.

- Reducing of travel time 12-16%.
- Reducing idling of vehicles
- Reducing of fuel consumption 9 -12%
- Reducing operating costs of transport
- Analysis of the use of cars in the organizations performing transportation

EXPECTED RESULTS AT THE IMPLEMENTATION OF THE NAVIGATION SYSTEM IN THE RA

safety of life and increase comfort

increase of efficiency of use in state transport

centralized provision of the navigation system in a wide range of users

The purpose of introduction of navigation systems in the Republic of Armenia is to solve in different sectors of the economy a number of management tasks on the basis of a satellite navigation system, monitoring, modern satellite navigation equipment in vehicles and the optimization of other movable objects.

Thank you for your attention

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