

UDC 630

State-Private Partnership and Personnel Preparation for Earth Monitoring From Satellites: Problems and Prospects

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ABSTRACT. Public-private partnership (PPP) nowadays is of more and more significance during training programs, scientific work, commercial use of intellectual property. This article provides an analysis of PPP examples between state universities and a private company “Engineering-technological center “SCANEX”.

Thanks to long-term relations and by uniting resources (technical, technological, information, educational) a university-based network of space monitoring centers was established which includes 22 leading universities of Russia, 2 universities of Spain and 2 universities of Kazakhstan.

Keywords: Earth remote sensing; satellite monitoring; GIS-technologies; geo-services; geo-portals; sustainable use of natural resources; monitoring; environmental security.

INTRODUCTION. A system of education in the Russian Federation has been significantly reformed and modernized at all its levels during the recent decade. These changes, first of all, touched a High school system. Innovations were implemented systematically and were characterized rather in terms of quality than in terms of quantity. The former include – Bologna process, multi-tier education model, differentiation among institutions of higher education (national universities, federal and research universities), establishment of specialized Federal target programs, intellectual property rights protection and more active implementation of intellectual property in education as well as commercial use of intellectual property, public-private partnership etc.

Public-private partnership (PPP) is defined as a form of cooperation between public authorities and a business, while the aim of PPP is to provide financing, maintenance, renovation and management of an infrastructural object or a service provision. Distinctive features of PPP: long-term relations; uniting resources for reaching a specific goal; distribution of responsibility and risks between private and public partners.

Despite the fact that some of disciplines of higher education (e.g. Economics, Law etc.) provide a much larger number of graduates than the demand is, a range of professions is in high demand on the market, for example Geomatics, GIS-technology, Geographic Information Systems.

These specialists are required in various branches of economy and in social business, especially during rapid development of modern space technologies which include Earth remote sensing, geo-services, geoportal technologies, 3D-technologies etc. A range of possible application of modern space technologies in economy and social sphere is quickly expanding. Up to nowadays traditional clients of space technologies have been represented by specialized companies, Emergency Ministry, Meteo Office, Transport Ministry, Forestry, Navy etc. At present day an active implementation of innovative technologies of Earth remote sensing is going on alongside with development of geoportal technologies and software for solving different economic and social tasks, among them are those for environmental security and sustainable nature management [2, 11-15].

Development of such uneasy projects and successful implementation of Earth remote sensing technologies by state educational institutions only is quite complicated or almost impossible. A particular role here is played by public-private partnership [7, 8].

Engineering and technical center (ETC) "SCANEX" (LLC) was established more than 20 years ago in a national institution "Moscow State University named after M.Lomonosov". Today SCANEX is recognized not only in Russia, but also abroad as a center for remote sensing systems development (ERS), development specialized software, geo-service and geo-portal technologies. Besides that, SCANEX is developing and financing special education programs for secondary and high school as well as social networks applications. For instance, SCANEX participated in creation of a network of regional ERS centers based on Russian and foreign universities.

University regional ERS centers allow for implementation of innovative technologies into the major profiles of universities:

- Education – training, advanced training and skill development of personnel who possess up-to-date knowledge in ERS and GIS-technologies used in management supportive systems;
- Scientific-research activities;
- Commercial activities – using intellectual property in different spheres. For example, monitoring of a territory of a region and providing almost online information to assist local authorities in decision-making process.

As of today regional ERS centers have been created in 22 universities. First of all, these are national universities (Lomonosov Moscow State University, Saint-Petersburg State University); 6 Federal universities: Southern, Siberian, Arctic, North-Eastern (Yakutia), Ural, Baltic federal universities; 7 research universities and specialized educational institutions. Besides Russian universities similar centers have been created in Spain and Kazakhstan.

University ERS centers are equipped with Russian-made satellite receiving stations. These are universal receivers of information UniScan^{TM24} and UniScan^{TM24} – a result of latest innovative technologies of ETC "SCANEX".

Station "UniScan"TM is designed to receive and process information transmitted from low-Earth orbit (LEO) ERS space vehicles equipped with electrooptical and all-weather radiolocation gear. Station "UniScan-36" allows receiving ERS data of various spatial resolution (less than 1 meter) which are radio-transmitted at 8 GHz frequency using a single channel of 320 Mbps. The station is a hardware and software system which can be additionally equipped with extra receivers. For example, SPOT 4, SPOT 5, FORMOSAT-2, RADARSAT-2 that allows combining broadband data of low resolution (Terra and Aqua vehicles), of regular HD monitoring (SPOT 4, SPOT 5, FORMOSAT-2) and of time and weather-independent radiolocating ERS (RADARSAT-2). Stations UniScan allow obtaining information from Russian and foreign space vehicles.

A consortium of universities "University Geo-portals (UNIGEO)" was created in March 2011 to coordinate works on joint scientific research, development of common projects and increasing awareness of students and faculty [3-5, 8].

The main goal of Consortium creation is development and implementation of a complex of measures aimed at efficient usage of the potential the High school possesses to develop and bring to life ERS technologies and GIS-technologies in Russian education, science and industry.

One of joint scientific projects of the Consortium is development of geo-services and geo-portals for different consumers.

Geo-services are a new form of geo-information solutions where data and data-based products are provided as end-user services available through the Internet or LAN of a company. Geo-services are based on WEB-GIS technologies (GeoMixer WEB-GISTM). Main advantages of this approach are:

- accessibility (one can get access to the system in any place and at any time, the only requirement is Internet connection);
- simplicity (working via an ordinary WEB-browser, no administrator or GIS-expert support needed);
- flexible licensing terms (legal use of geodata (maps, satellite photos) in Intranet and Internet);
- joint work (sharing a project with colleagues or worldwide requires just sending a link or embedding the project into one's own website via API);
- access security (one can create either public or private projects granting access to them for selected users only – for viewing, editing etc.)

The most interesting, in terms of environmental security, are the following projects:

1. Monitoring of spring floods on Russian rivers using up-to-date satellite photos of various spatial resolution (<http://rivers.kosmosnimki.ru>). The project was made by ETC SCANEX together with the National emergency control center of Emergency Ministry of Russia in spring 2010.

2. Monitoring of forest fires in summer 2010 using up-to-date satellite photos of various spatial resolution (fires.kosmosnimki.ru).

3. Monitoring of oil spills using up-to-date satellite photos of various spatial resolution in Russian seas, including Black sea (<http://ocean.kosmosnimki.ru>).

4. Monitoring of violations/changes within Special protected natural areas (<http://oopt.kosmosnimki.ru>) etc.

These works have been done using software Scanex Web GeoMixer DATA developed by ETC SCANEX, which is represented by geo-services of access to basic spatial data: satellite photos, maps, address databases etc.

Scanex Web GeoMixer is a web-mapping tool for access different geo-data and geo-information services. Using GeoMixer one can easily and quickly create own projects in the Internet or Intranet (from display of address database to creation of thematic maps) and then grant access to them to an unlimited number of users using different levels of access rights.

Using GeoMixer one can publish own geo-data in the Intranet or Internet, overlaying them above source data and granting access to them to an unlimited number of users using different levels of access rights.

GeoMixer also has an API component which allows embedding created projects into third-party websites and applications and manage the interactive map on a software basis.

Geo-portals. Russia, as well as the rest of the world, enjoys an increasing demand on geo-spatial data and services of their up-to-date provision via different media. For this reason creation of geo-portals of different purposes is highly required and is a highly profitable way of development of geomatics. Yet an issue of absence of up-to-date maps is very burning. At the same time there is little hope for sooner improvement of the situation. A possible solution of the problem is creation of a regional geo-portal based on up-to-date satellite photography of the territory that allows using cutting edge GIS-technologies in area management.

At present in the domestic market, besides Google Earth which is now available in Russian, commercial services on geo-spatial transfer of data are provided by search engine Yandex and geo-portal www.kosmosnimki.ru, satellite coverage for which was created by experts from ETC SCANEX. In the framework of geo-portal www.kosmosnimki.ru a mosaics of satellite photos of Central, Southern, Privolzhsky and some areas of North-Western Federal Districts is presented (spatial resolution less than 2 meters) as well as of some large cities of Russia (spatial resolution 0.5 meters). Satellite monitoring allows to discover operatively forest fires, floods and other emergencies alongside with controlling status of objects and monitoring the environment as a whole [1, 6].

An example of foreign regional specialized ERS center is “Alpine space center” [10]. Alpine Space Programme is a transnational program of interaction in the Alps for the EU. Partners from 7 alpine countries apply joint efforts for sustainable regional development, especially in regions enjoying winter tourism.

The International Olympic Committee in 2007 made a decision on holding XXII Winter Olympic and XI Winter Paralympic Games in Sochi. Sochi state university is not just a center of volunteer and personnel training for sport venues and tourist infrastructure objects, but it takes an active part in environmental activities, such as safety measures, and in monitoring of the construction of Olympic projects envisaged by the Program of Olympic Construction (hereinafter – the Program) [8].

The faculty of Sochi state university together with ETC SCANEX have developed a pilot project of geo-portal “Sochi – Winter Olympic Host City”.

Primary tasks of the project: monitoring of construction of Olympic projects in Alpine and Coastal clusters, vegetation monitoring, environmental activities, nature safety measures in construction areas.

Figure 1 shows Imeretinsky lowlands, agricultural grounds of state farm "Russia", 2007, prior to the beginning of building of sports Olympic objects (SPOT-5 satellite, permission of 2 meters, space pictures of JSC «SKANEKS»).

Figure 2 shows combined digital maps of Coastal Olympic cluster (Imeretinskaya lowland), satellite photo received from a French “SPOT 5” and a construction schedule according with the Program [8]. A piece of geo-portal listed in Figure 1 was built using 2007 data, resolution is not less than 2 meters.

Monitoring of construction of Olympic projects (Fig. 3–6), was made by satellite photography every 2–3 months as well as using old photos (geo-portal www.kosmosnimki.ru). Digital maps of vegetation in Coastal and Alpine clusters were initially drawn to control and monitor influence of construction on the environment (Fig. 6). For these purposes a zoning of the territory was made, sectors of homogeneous forests were defined together with their areas.

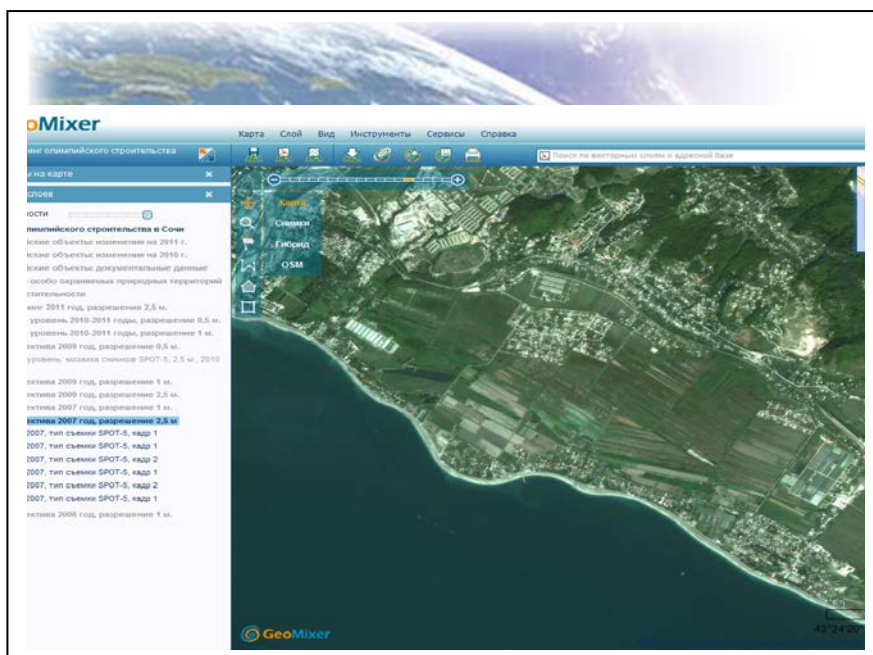


Figure 1: Imeritinsky lowlands, agricultural grounds of state farm "Russia", 2007, prior to the beginning of building of sports Olympic objects. SPOT-5 satellite, permission of 2 meters, space pictures of JSC «SKANEKS».

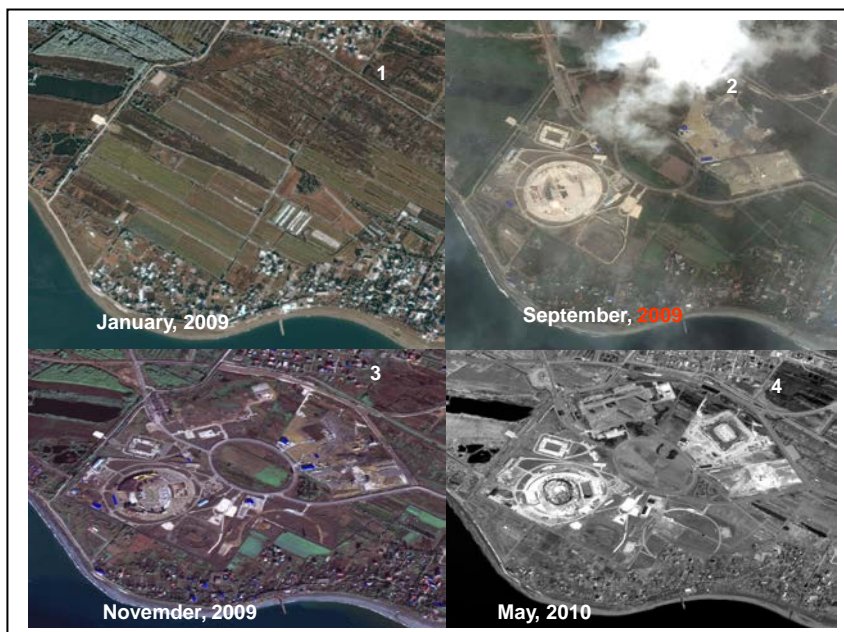


Figure 2: Monitoring of construction of Olympic projects in coastal cluster. Satellite photo of Imeretinskaya lowland, 2009 -2010. JSC «SKANEKS» pictures, 2011.

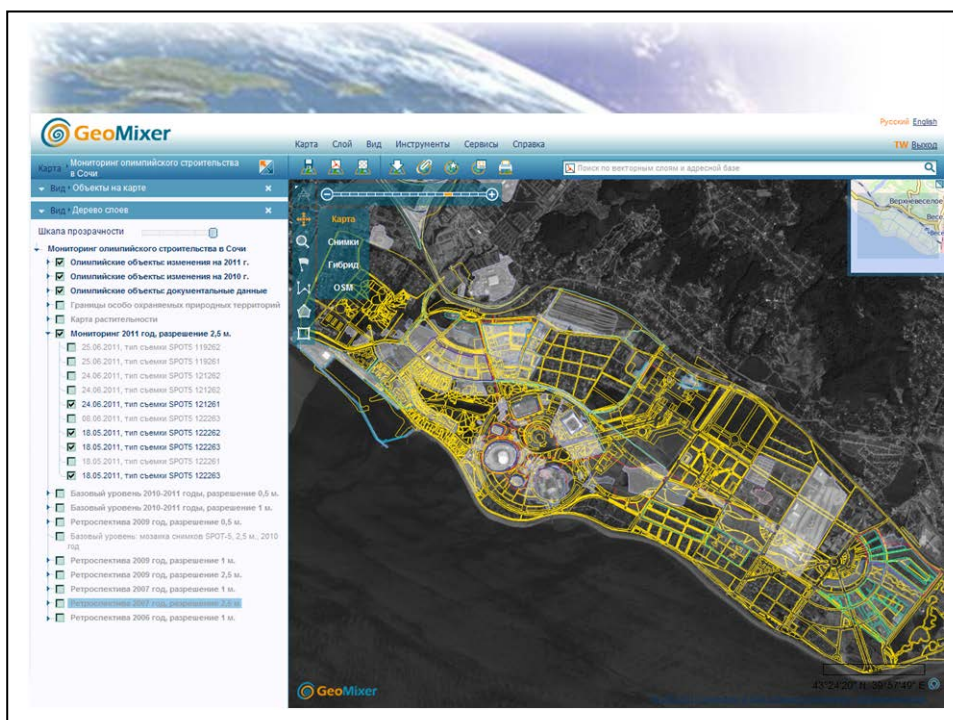


Figure 3: Monitoring of construction of Olympic projects in coastal cluster. Satellite photo of Imeretinskaya lowland, 2011 (red and green colours indicate deviations of projects under construction from previously designed). JSC «SKANEKS» pictures, 2011.

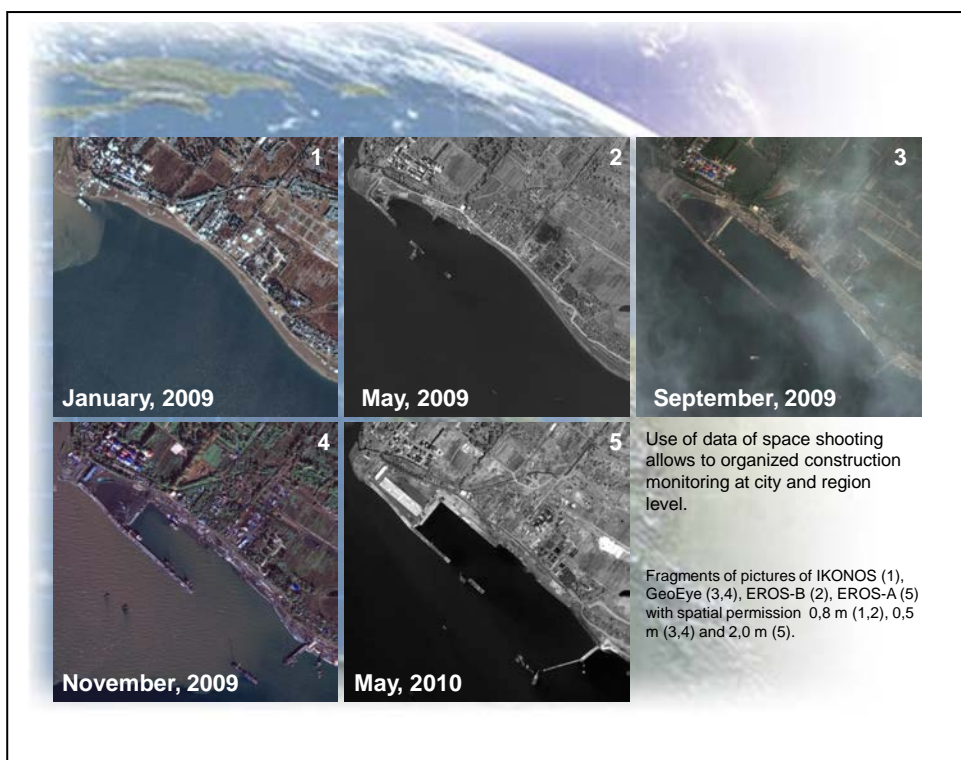


Figure 4: Monitoring of construction of cargo port of Adler, a coastal Olympic cluster. Pictures of JSC SKANEKS, 2009–2010.

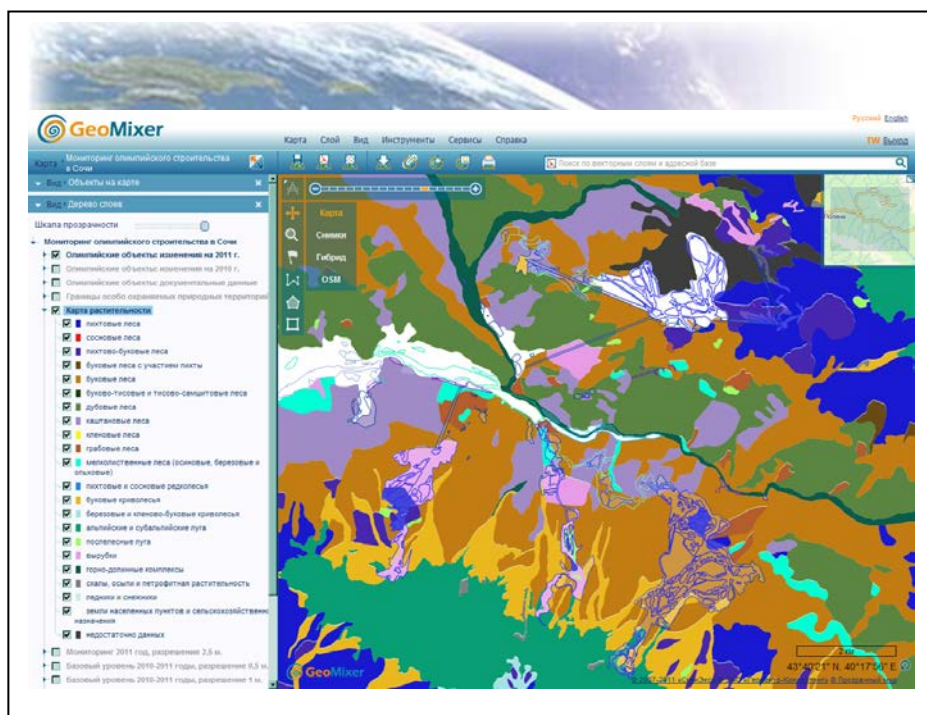


Figure 5: Combined map of sports Olympic objects of the Mountain Olympic cluster of "Sochi-2014" and vegetative cover. Fragment of a geoportal of JSC SKANEKS, 2011.

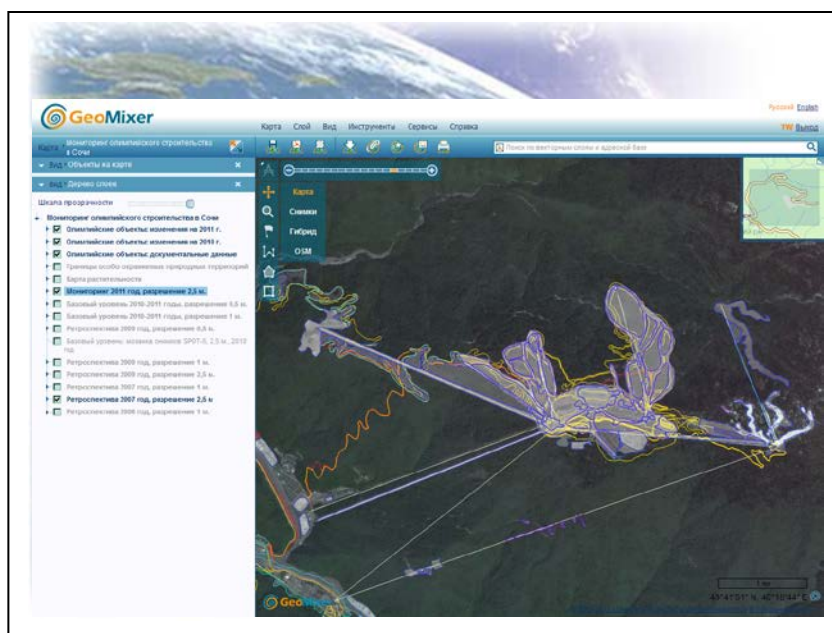


Figure 6: Imposing of a schematic map of building of sports Olympic objects of the Mountain Olympic cluster of "Sochi-2014" and the pictures received from satellites of Earth. JSC «SKANEKS» pictures, 2011.

Vegetation monitoring allows operative defining areas of illegal forest chopping, looking for unlawful landfills, monitoring of forest fires location and spreading, etc. Figure 7 shows area of the river of Dzykhra of the Mountain Olympic cluster. Unauthorized increase in the area of the range for a construction waste on object «Combined automobile and the railway: Adler – the Red Glade». Picture of JSC «SKANEKS», 2011.

Thus, summarizing the above-mentioned, it is important to note:

1. Using modern means of space monitoring (ERS) allows solving a wide range of tasks aimed at increasing the efficiency of regional management, tax collection, nature-based economy, environmental control and protection.
2. Technologies of space monitoring, including geo-portals and geo-services, are a state-of-the-art means of information support of management.
3. Using space technologies allows increasing payback of investments, making proven management decisions on an operative basis:
 - a. to provide environmental safety;
 - b. to implement and control measures aimed at sustainable nature usage, especially during realization of national large-scale projects (APEC summit, University Games, Olympic Games Sochi-2014);
 - c. for emergency situations mitigation;
 - d. for monitoring of nature-protecting activities etc.

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УДК 630

Частно-государственное партнерство и подготовка персонала для спутникового мониторинга Земли: проблемы и перспективы

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Аннотация. В наше время частно-государственное партнерство приобретает все большее значение во время обучающих программ, научной работы, коммерческого использования интеллектуальной собственности. В данной статье представлен анализ примеров частно-государственного партнерства между государственными университетами и частной компанией «Инженерно-технологический центр «СКАНЕКС». Благодаря долгосрочным отношениям и объединенным ресурсам (техническим, технологическим, информационным, образовательным) была учреждена сеть центров мониторинга космоса на базе университетов, которая включает 22 ведущих университетов России, 2 университета Испании и 2 университета Казахстана.

Ключевые слова: дистанционное зондирование Земли; спутниковый мониторинг; технологии ГИС; геосервисы; геопорталы; устойчивое использование полезных ископаемых; мониторинг; экологическая безопасность.