

UniScan X-band ground station is the base for university laboratory of Earth observation for investigation of global changes

Vladimir Gershenson¹, Olga Gershenson², Marina Sergeeva³, Vitaly Ippolitov⁴

¹R&D Center ScanEx, 5/22 Rossolimo Str., Bld. 1, 119021,
Moscow, Russia
veg@scanex.ru

²R&D Center ScanEx, 5/22 Rossolimo Str., Bld. 1, 119021,
Moscow, Russia
olga@scanex.ru

³R&D Center ScanEx, 5/22 Rossolimo Str., Bld. 1, 119021,
Moscow, Russia
sergmarina@scanex.ru

⁴R&D Center ScanEx, 5/22 Rossolimo Str., Bld. 1, 119021,
Moscow, Russia
vitaly@scanex.ru

Abstract. Delivering targets of boosting the economic competitiveness of any country is not possible without reinforcing the role of the higher professional education. Today, the conventional education, as an access to learning, can not keep up with the current requirements of science and industry.

Russian company SCANEX R&D Center believes that setting up Research and Development Centers based on the Earth space imagery technology within the structure of the Universities is the solution of the above problems. This will provide the proper environment to deliver the efficient training for scientific and academic and teaching personnel, secure the role of the young professionals in science, education and hi-tech, and maintain the continuity of generations in science and education. SCANEX Research and Development Center has delivered the land based UniScan centers to over 20 higher education institutions in Russia, Kazakhstan, and Spain. These stations serve as the basis for space monitoring centers providing the training and advanced training to produce the specialists having the state-of-the-art knowledge in Earth Remote Sensing and geographic information systems, as well as the territorial monitoring and geo-data service for the economic operators in such diverse areas as the nature resource management, agriculture, land property management etc.

Since early 2009 satellite imagery service to the Universities has extended worldwide outside the Russian territory, providing EROS A satellite imagery at 1.8 m resolution, IRS-1D imagery at 5.8 and 23 m, and SPOT 4 satellite imagery at 10 and 20 m resolution. Based on the Agreement between SCANEX RDC and the operators of the respective Earth Remote Sensing space programs, and on flexible financial terms, the international universities can purchase the universal compact UniScan stations. The station users also get a free one year license to receive the satellite imagery. The proposal is unique in the way that it is the first time the systems are delivered to the customer other than major state department space imagery receiving centers.

Creation of state-of-the-art remote sensing centers at the universities will lead to a new quality level for education and scientific studies and will enable to make education system in such innovation institutions open to modern research work and economy.

Keywords: Earth remote sensing, space monitoring centers, UniScan™ ground station, geo-portal

1 Introduction

Inclusion of higher education schools in Bologna process sets a mission of quality support and quality assurance as the top priority in improving higher education.

Such an index as the education quality comes along with education results, currently most often referred to as “competence”. Innovation of education should be more competence-oriented than passing of knowledge that always gets out of date. Following this pattern knowledge can be acquired on an individual bases. Such kind of education should be more connected to practice than the traditional one.

Reducing competitiveness of traditional education institutions, as well as insufficient science and production integration indicate that new types of higher education institutions should be created. Nowadays, traditional education as the system of gaining knowledge lags behind the actual current requirements of contemporary science and production.

2 Solution from SCANEX R&D Center

One of the solutions to resolve these problems can be the introduction of Remote Sensing Centers or laboratories for Earth observation from Space for global changes as research and development links in the chain of universities. This will allow the students to master practical skills having an ultra-modern laboratory base.

Traditionally remote sensing centers at universities are equipped with ground stations enabling to receive free data, such as worldwide known AVHRR from NOAA satellites series with resolution of 1,100 m and MODIS from Terra and Aqua satellites with 250, 500 and 1,000 m resolution. Important positive peculiarity of these data is that there are many open and free software tools and many of them can be found in Internet. This opens a wide field for students and researchers to change of knowledge, ideas and new developments investigating AVHRR and MODIS data for global changes on vast territories. But at the same time low resolution of these data makes considerable restrictions for their practical applications for more precision changes of local areas of the Earth.

At the same time one who wishes to receive data with middle and high resolution faces with such problems as high price for ground station and expensive telemetry fee. Usually only national large remote sensing centers have a possibility to receive data with middle and high resolution. However, it remains a dream for universities...

As a result of agreement between world Operator of EROS Mission ImageSat Int. N.V. and R&D Center ScanEx universities not only in Russia, but all over the world get a possibility to use images of resolution with 1.8 m from EROS A satellite in educational and research process. This became a reality because UniScan™-24 ground stations manufactured by R&D Center ScanEx will be supplied to universities all over the world on flexible commercial conditions. At this 100 EROS A images for the first year of UniScan™-24 operation will be included into the complete set of the delivery. At this combination of images with low resolution but with wide swath width and images with high resolution but with narrow swath width allows to investigate change detection both for vast areas and local ones.

3 Experience and technology

To date, there are over 20 Remote Sensing Centers operating on UniScan™ ground stations deployed at the leading universities in Russia, Kazakhstan and Spain. In the most cases they receive MODIS data. But among them 7 UniScan™ ground stations in universities of Russia are equipped not only for MODIS data, but for other satellites (SPOT 4, IRS-P5, IRS-P6, EROS A/B, RADARSAT-1) thanks to flexible licensing policy implemented in the Russian Federation.

SCANEX R&D Center technology-based research and development centers have already been operating with an excellent track record in such Russian Universities as Altay State University, Belgorod State University, Ufa State Aviation Technical University, Tyumen State University, Moscow State Technical University n.a. N.E. Bauman.

Samara Space Geoinformation Center has been operating in Samara State Aerospace University since December 2006 (SSAU), and is currently the best equipped Earth Remote Sensing center in Russia and former Soviet Union states, not only among the educational facilities, but also the state and private space monitoring centers.

Earth Remote Sensing Centers have been launched in 2007-2008 as a part of "Education" National Project in Siberian and Southern Federal Universities.

The ground receiving centers deliver the real-time training for executive decision making support technology at the regional and municipal levels. The Centers can also provide the commercial service as well, e.g., training at professional development programs, contracted areal monitoring work management in a range of various applications (management of natural resources, agriculture and forestry management, emergency response, mapping updates, cadastral work, etc.) or research and development in various fields of knowledge.

It has been currently the worldwide practice to set up Space Monitoring Centers at the higher education facilities and other educational organizations. Thus, UniScan™ based ground receiving centers have been in operation at Kazakhstan-British Technical University of Republic of Kazakhstan (Almaty) under the auspices of Kazakhstan System Modeling Research Institute, at Satpayev Kazakhstan Research Science and Technology Institute (Almaty), at two universities in Spain

(Valladolid and Valencia), and negotiations are in progress with Anatolia University in Eskishehir, Turkey.

UniScan™-24 ground station is intended for receiving and processing information transmitted from Earth low-orbit satellites via X-band radio channels with the data rates up to 170 Mbps in one channel. Such rates correspond to images with a spatial resolution better than 1 meter. At present the UniScan™-24 station provides for reception and processing of data from Terra, Aqua, IRS-P5, IRS-P6, CARTOSAT-2, SPOT 4, EROS A, EROS B and RADARSAT-1, ENVISAT-1 satellites.

UniScan™ hardware is universal and programmable and, in most cases, ground station can be upgraded for new satellites on the software level.

UniScan™ is completed with software for data reception, preliminary processing, archiving, cataloguing and creation of thematic products further to be imported into various GIS formats and applications. The most popular among the specialists in Remote Sensing and GIS are ScanMagic® and ScanEx Image Processor® software applications with more than 200 licenses throughout Russia and abroad.

4 Remotely sensed data application

Data received from the satellites in real-time are converted into ready-for-further-analysis products within 0.5-1 hour after being received from space, which indicates a high operational degree of the process (no data, available via Internet, can be obtained in such a quick mode).

Contemporary remote sensing center at a university allows to:

- turn the university into one of the world leading education institutions equipped with cutting-edge technology and firmware for Earth observation from space (footprint of ground station is about 12 million square kilometers);
- carry out training and advance training of specialists having skills in remote sensing and GIS, used for decision-making support;
- monitor territories and submit data in support of decision-making of regions and sub-regions.

Remotely sensed data received by remote sensing center of a university will allow resolving following practical tasks concerning change detection using different types of remotely sensed data both optical and radar:

- topographic maps updating;
- forest fires early detection and monitoring;
- ice and snow cover condition operational assessment;
- on/off shore oil spills detection within the oil production and transportation areas;
- ecological situation of water areas and new seaports, pipelines and oil terminals construction sites;
- illegal fishing control;
- license agreements compliance monitoring within the fields of natural resources development;
- forestry monitoring (logging dynamics, logging status);
- agricultural monitoring for crop rotation rules observation and proper arable lands use;
- illegal construction control;
- monitoring of infrastructure development;
- independent and operational natural disaster damage assessment;
- hydraulic structures condition monitoring;
- creation of up-to-date thematic maps of natural objects condition (vegetation, soil cover, areas hazard rate, etc.);
- environmental impact assessment of a territory development.
- solution of hydro-meteorological and weather forecast tasks; environmental monitoring and others.

5 Conclusion

Creation of state-of-the-art remote sensing centers at the universities will lead to a new quality level for education and scientific studies and will enable users to make educational system in such innovation institutions open to modern research work and economy.