

DEVELOPMENT OF INFORMATION AND TELECOMMUNICATION AND SPACE TECHNOLOGIES USING NEW MECHANISMS OF TECHNOLOGICAL PLATFORMS

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Abstract

The relevance and perspective of the technological platform "Information and telecommunication and space technology for innovative development of Siberia" with the active participation of the Siberian State Aerospace University are discussed. The technology platform is a form of implementing public-private partnership, a way of mobilizing capacity of stakeholders (government, business, scientific community) and tool for creating science, technology and innovation policy to maintain the innovative development and technological modernization of the economy as part of the development of information and telecommunication and space technology.

Key words: *technology platform, information and telecommunications and space technology.*

At the current stage of innovative development and modernization in economy, one of the most important instruments of state scientific-technological and innovational policy is the development of technology platforms and innovative development programs of public companies. This is a new mechanism of public to private partnership and a synergy of high-tech enterprises, businesses, and academics for the consolidation of resources in designing advanced commercial technologies, new products and services, and research and development at an international level.

The innovative development programs are formed by companies during a middle term (5 – 7 years) in order to enhance innovations at enterprises, increasing this demand in the near future. The programs should include activities aimed at the development and introduction of new technologies, products and services, which correspond to international standards, are integrated into the companies' business strategies and are aimed at significant improvements in key performance indicators of the production process.

Among the requirements for the development of innovative programs of companies with state participation is the cooperation between manufacturing enterprises, universities, and research facilities. This includes the following procedures:

- selecting a university or research organization, defining the scientific and technological spheres, the percentage of joint research, and technological work;
- joint realization of research programs, exchange of scientific, technical, and marketing information; activities in the field of forecasting technological development;
- implementing the agreed programs within the university course to improve the quality of education and training for future employment in high-tech industries;
- mutual participation of company employees, research organizations, and universities in collegiate bodies of management and advisory boards.

The "Strategy of Innovative Development of the Krasnoyarsk Territory to the year 2020" program provides the implementation of innovative programs for the development of the region and the establishment of a number of regional technological platforms, one of which is the "Information and Telecommunication and Space Technology for Innovative Development of Siberia" platform. The Siberian State Aerospace University (SibSAU) acts as a successful example of coordinating the process of establishing and developing regional technology platforms.

An important factor in the formation of regional technology platforms has been the approval by the Federal Interbranch Technology Platform – "National Information Satellite Systems" – directed by the Government of the Russian Federation. This concept had been developed by JSC "Information Satellite Systems" named after academician M.F. Reshetnev" (JSC ISS) in cooperation with SibSAU. The "National

Information Satellite Systems” technology platform is a form of implementing public to private partnership; a way of mobilizing the capacity of stakeholders (government, business, and the scientific community). It is also a tool for developing policies in science, technology, and innovation for the maintenance of innovative progress and the technological modernization of the national economy in terms of solving socioeconomic problems and increasing the availability of radical expansion in the exploit of space-based services.

SibSAU’s participation as coordinator in the establishment of the “Information and Telecommunication and Space Technology for Innovative Development of Siberia” regional technology platform is a historically justified event. In fact, the entire history of the Siberian State Aerospace University is inseparably linked to the development of a major space and rocket complex in the Krasnoyarsk Territory.

The innovative activity of the university in the rocket and space sphere is carried out in three major areas of priority development – space information systems, closed manned space systems, rocket and space engineering. The university is license to perform space engineering activities.

The opening of the “Spacecraft and Systems” university resource center and equipping it with the latest specialized equipment is an important step for further development of a wide range of research and development.

In the center, a team of students, post-graduate students, young scientists, and specialists of JSC ISS are working on designing a series of scientific and educational minor satellites (Smallsats) and are carrying out scientific and technological experiments in space (Kovalev & Loginov, 2011). The material base of the center makes it possible to realize the assembly and testing of Smallsat mechanical systems, prototyping electronic equipment, conducting vacuum and climatic tests, and conducting studies in spacecraft electronic equipment.

The first minor satellite of the SibSAU series was named *Yubileyniy*; it had been launched into space and operated for three years. The second student minor satellite *MiR* was launched into orbit in 2012 and continues to successfully operate (Fig. 1).

The concept of the “Information and Telecommunication and Space Technology for Innovative Development of Siberia” regional technology platform considers the positions of all shareholders – the government, industry, academics, consumers, and enterprises (Kovalev & Loginov, 2012). Primarily, the potential of the engineering market is analyzed – this provides an understanding in the selection of strategic research areas, promising projects, and services at all stages of consolidation between public and private funding.

The strategic goal of the “Information and Telecommunication and Space Technology for Innovative Development of Siberia” regional technology platform is the insurance of applying information, telecommunication, and space technology for the socioeconomic development of the Krasnoyarsk region.

The activities of the regional technology platform:

- remote Geosensing from space;
- GLONASS navigation systems;
- modern digital communications;
- computing and telecommunication technologies;
- information system management of territorial socioeconomic development.

To achieve the objectives, the following has been proposed:

- the unification of efforts from SibSAU, Siberian Federal University, JSC ISS, Krasnoyarsk Scientific Center of the Russian Academy of Sciences, and the Ministry of Emergency Situations in order to create a regional center of space services, using the currently available equipment for obtaining and processing data from space in order to prevent forest fires, monitor woodlands, forecast crop harvest, monitor transport and environmental conditions;
- the modernization and expansion of the monitoring system of transport in the Krasnoyarsk Territory, using satellite dispatching in absence of cellular coverage;
- the development of navigation and information systems to monitor the conditions of buildings, structures, and conducting geodynamic studies, using GLONASS;
- the development of GLONASS technologies that provide automatic mooring and landing of aircraft on poorly equipped airfields;

- the development of an integrated network of computing resources, storage resources, and telecommunication resources, including software virtualization (GRID Krasnoyarsk Territory) and service-oriented architecture (cloud services) to meet the information needs of the public and enterprises;
- the distribution of technological electronic interaction between government authorities, enterprises, and the general public, corresponding to contemporary needs of society;
- the inclusion of the regional GRID into the information space of the Far East, the APEC and the SCO countries;
- the implementation of forecasting and analysis, strategic planning and development of information and telecommunication and space technology, identifying development priorities, including the use of new information and communication tools, examination of projects at different levels, advising government at the platform profile.

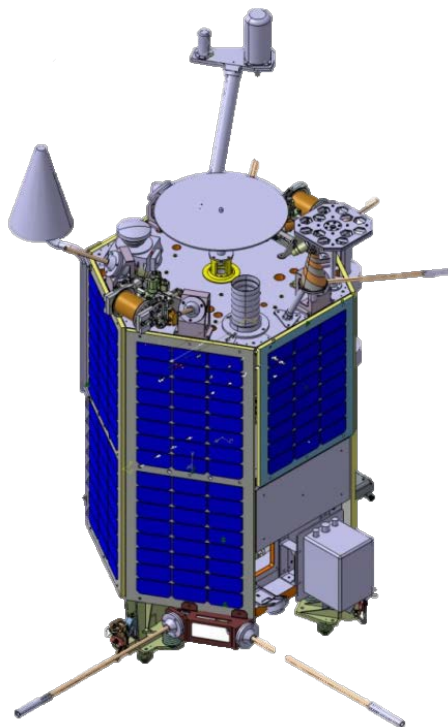


Fig.1. Minor satellite "MiR" was launched in August 2012.

The initiative group of the regional technology platform from the Krasnoyarsk Territory includes the JSC ISS, SibSAU (university coordinator), the Krasnoyarsk Scientific Center of the Russian Academy of Sciences, Siberian Federal University, and other organizations.

The interaction participants of the platform are shown schematically in Fig. 2.

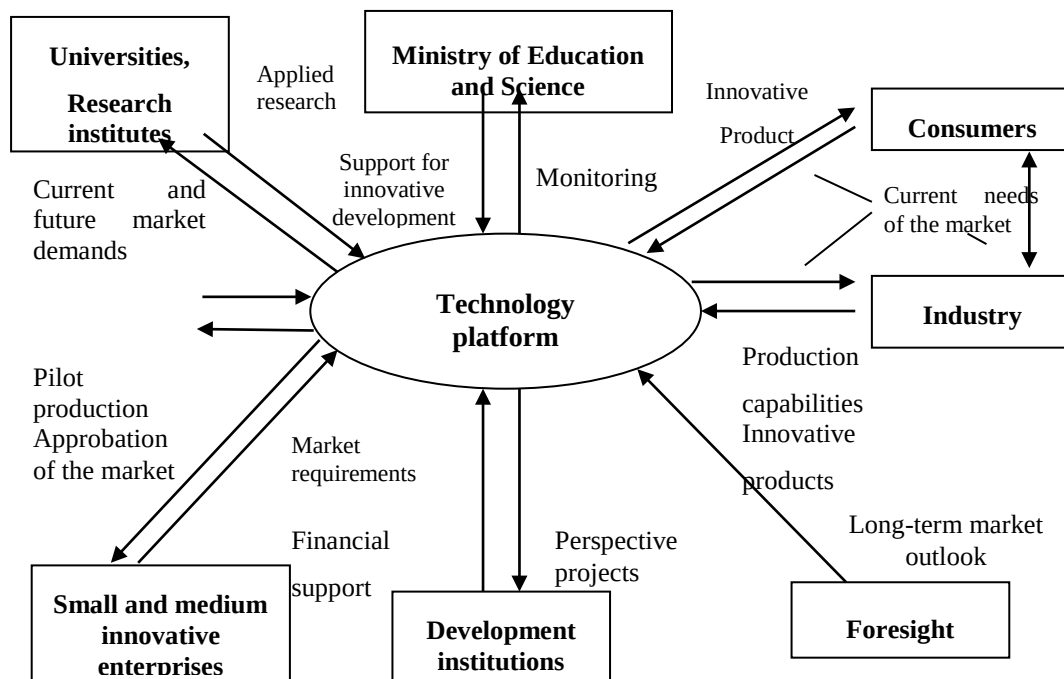


Fig. 2. Participants of the interaction platform.

The organizational structure of the regional technology platform is shown in Fig. 3.

To coordinate activities of the technology platform, the scientific and technical council, expert working groups, as well as bodies of operational management of platform were assembled.

For combining activities of the organizations in the provision of satellite services, a regional center for space services (RCSS) has been established in the Krasnoyarsk Territory. In this connection, the spatial data infrastructure of the Krasnoyarsk Territory had been created. This is a resource, which enables estimating levels of soil contamination, percentage of farm land, road conditions, and other monitoring in the region. Companies and various organizations of the region, interested in using the results of space activities could receive up-to-date information for management and making operational decisions. The information will be available to residents of the region on the informational portal of the "Bank of Spatial Data of the Krasnoyarsk Territory» (www.24bpd.ru). The Ministry of Information and Communication of the Krasnoyarsk Territory collects data on the needs and ways of introducing results of space activity in the functioning of the state. Cooperation with executive bodies of the Krasnoyarsk Territory in the application process of real-time actual satellite images in emergency situations to prevent technogenic and natural disasters in the territory has been considered.

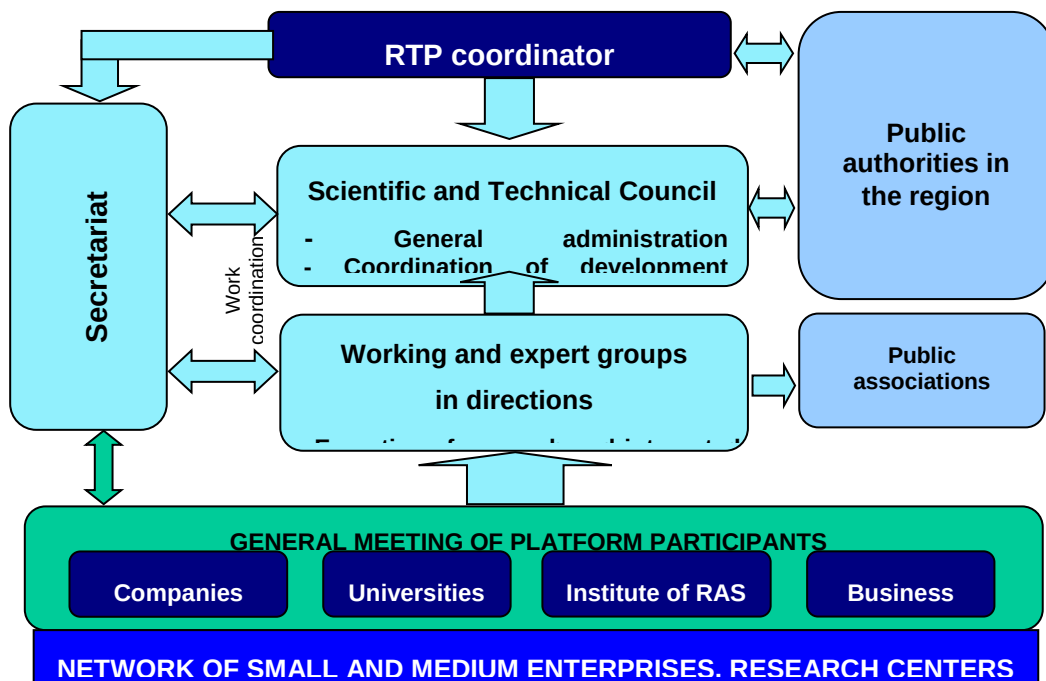


Fig. 3. The structure of the regional technology platform.

Certain work has been done within the regional technology platform.

On the basis of the Siberian State Aerospace University and Siberian Federal University, receiving complexes of remote sensing data from space have been installed and are currently functioning. The obtained data can be gathered by an extensive list of spacecraft: Terra, Aqua, Suomi NPP, Spot-5, Spot-6, UK-DMC2, Formosat-2, Resource-DK1, Eros A, Eros B, Radarsat-1, Radarsat-2, Envisat-1, TerraSAR-X, TanDEM-X, Landsat-5, Landsat-7, and Meteor-M. In the sphere of Earth remote sensing, university students, post-graduate students, and staff participate in the development of methods to improve the accuracy characteristics of GLONASS / GPS; they develop tools and methods for monitoring natural resources and remote sensing, as well as radar and radio thermal sensing from space. The basic functionality of the system enables the preprocessing, accumulation, and indexing of remote sensing data, acquired by satellites SPOT-4, Landsat-5, QuickBird, Aqua, Terra, the NOAA database, and search scenes in web-based interface.

Simultaneously, the Siberian Federal University created an effective complex of reception, storage, and standard processing of satellite imagery. This complex operates in a distributed mode, running different operating systems. The software component system includes a high-performance database management technology – Microsoft Silverlight – it supports motion applications that contain animation, vector graphics, audio and video clips. In processing the input stream of satellite data, the supercomputer of the university is involved. The catalog of satellite images is extended by adding freeware data repositories – Landsat-5, Landsat-7 images. The volume of accumulated data since 2008 is about 20 Tb, and it continuously increases due to rapid image taking.

In order to implement the Agreement on Social and Economic Cooperation between the government of the Krasnoyarsk Territory and JSC “Scientific and Industrial Corporation REKOD”, the Center for the Popularization of Space Services was founded in 2013. For the purpose of popularizing space services, the center promotes existing space technologies and distributes space activity results in order to improve the socioeconomic development of the region. The priority in the popularization of space information is the training of public officials and the inclusion of this information into university and school curriculums. The study of modern information and space technology should be advertised through the Internet to students, state and municipal employees. The public will accelerate the advancement of these technologies in the economy and management of the region.

The results of logical development in the field of space activity are accumulated at SibSAU and JSC ISS in a major international project – the International Global Monitoring Aerospace System of Earth's surface, atmosphere and near-Earth space with data observations in ground control centers during crisis situations in near real-time for predicting and preventing natural disasters and man-made disasters (Menshikov, 2010).

In solving the tasks of the regional technology platform, it has been planned to actively exploit the potential of the major Roscosmos Industrial Center of Transformable Mechanical Systems, on base of which JSC ISS provides comprehensive research and the assembly of a large transformable mechanical systems (large diameter antenna reflectors, large area solar panels, etc.), including all stages of design, development, manufacturing, testing, and personnel training. The joint project of the university and the JSC ISS with the Organization of Import Substitution Production of Precision Spacecraft Structural Elements, using High-Modulus Composite Materials is executed in order to develop the regional technology platform.

CONCLUSION

The “Information and Telecommunication and Space Technology for Innovative Development of Siberia” regional technology platform is intended as a permanently open communication platform for interdisciplinary discussion, analyzing demand, developing and implementing of perspective projects. The project should concentrate the funding of research and development in those areas that are most important and crucial to the goals at all stages of project development. As part of the development of the regional technology platform and the regional center for space services will be the development of infrastructure network for science and technology and human resources development, creation and use of space information technologies and communication, navigation and monitoring of socio-economic development, governance and security in the region.

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