

Major provisions of the Russian Federal Space Program for 2006-2015

Special complete edition of the Russian Federal Space Program for Roscosmos web-site

APPROVED
By Resolution № 635
of the Government
of the Russian Federation
of Oct. 22, 2005

FEDERAL SPACE PROGRAM OF THE RUSSIAN FEDERATION for 2006 - 2015

Major Provisions

Russian Federal Space Program which covers period from 2006 to 2015 has the following structure:

- Log-Book of the Program
 1. Description of the Issue to be Solved by the Program
 2. Objectives, Goal, Due Dates, Milestones, Indicators and Indexes of the Program
 3. System of the Programmatic Actions
 4. Resource Provision of the Program
 5. Mechanism Applied for Program Accomplishment
 6. Estimation of the Socio-Economic and Ecological Effectiveness of the Program
- Appendix №1. Principal indicators and indexes of the Russian Federal Space Program for 2006-2015
- Appendix №2. Actions of the Russian Federal Space Program for 2006-2015
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Log-Book of the Program (major provisions)

The Program is titled Federal Space Program of the Russian Federation for 2006 - 2015

The decision about development of the Program is dated Apr. 3, 2003 (Protocol № 11: Meeting of the Government of the Russian Federation of Apr. 3, 2003)

State Customer: Russian Federal Space Agency

Primary developers of the Program are: Russian Federal Space Agency; Russian Ministry of the Civil Defense Affairs, Emergency Situations and Natural Disaster Accident Management; Russian Ministry of Industry and Power Engineering; Russian Ministry of Defense; Russian Ministry of Transport; Russian Ministry of Informational Technology and Communication; Federal Office of Hydro-Meteorology and Environment Monitoring; Fishery Federal Agency; Federal Agency of Geodesy and Mapping; Russian Academy of Sciences; Central R&D Machine-Building Institute Federal State Unitary Entity; the Organization Agat Federal State Unitary Entity; Keldyish R&D Center Federal State Unitary Entity; Technomash R&D Union Federal State Unitary Entity.

Goal of the Program – is to satisfy increasing needs of the state governmental institutes, regions, and the citizens of the country, by providing space technologies and services on the basis of the following:

- Enhanced and improved effectiveness of the space utilization, to achieve the objectives of the Russian Federation which cover economical, social, scientific, cultural and other areas, as well as for the benefits of the Russian security;

- Enhancement of the international cooperation in space and accomplishment of the international commitments of the Russian Federation in this area, and in development, application and shipment of the space items;
- Consolidation and evolution of the space potential of the Russian Federation, which is to support development and utilization of the required space system nomenclature to have the characteristics compliant with the world development level of the space technologies, as well as guaranteed access and essential presence in space.

Principal Objectives of the Program -

- Development, accomplishment, augmentation and maintenance of the orbital spacecraft constellation for the benefits of the socio-economical field, science and security of the country (communication, TV-broadcasting, relay, Earth remote sensing, ecological monitoring, emergency management, fundamental space research, space microgravity research);
- Development, deployment and maintenance of the International Space Station (ISS) Russian Segment (RS) elements for fundamental and applied research, implementation of the long-term scientific and applied research and experiments, planned to be conducted in the ISS RS;
- Support of the KOSPAS-SARSAT International Search and Rescue System's Russian Segment functioning;
- Development of the advanced launch vehicles;
- Maintenance and enhancement of the objects located at the Baikonur space port;
- Sustaining development of rocket and space technologies with the world-level characteristics

Due Dates and Milestones of the Program – 2006 – 2015

The first stage (up to 2010) is devoted to development of:

- The fixed-communication and TV-broadcasting space system which comprises 13 spacecraft;
- Mobile satellite communication system which comprises 6 spacecraft;
- Weather monitoring space system which comprises 5 spacecraft;
- Environmental monitoring space system which comprises 4 spacecraft;
- Space facilities for fundamental space research which comprise 2 astrophysical research observatories,
 - 1 spacecraft for Sun and solar-earth link studies,
 - 1 spacecraft for Mars research and delivery of Martian soil to the Earth, single small spacecraft and life-science research spacecraft;
- Russian Segment of the KOSPAS-SARSAT International Search and Rescue System which comprises 2 spacecraft;
- ISS RS which comprises 5 modules;
- Space data acquisition, registration and processing multifunctional ground facility and integrated Earth remote sensing satellite system based on this facility.

The second stage (up to 2015) is devoted to augmenting and maintaining the following orbital constellations:

- The fixed-communication and TV-broadcasting space system which comprises 26 spacecraft;
- Multifunctional relay system which comprises 2 spacecraft;
- Mobile satellite communication system which comprises 12 spacecraft;
- Weather monitoring space system which comprises 3 spacecraft of the fourth generation and 2 spacecraft of the third generation;
- Environmental monitoring space system which comprises 5 spacecraft;
- Space facilities for fundamental space research which comprise 3 astrophysical research observatories;
 - 3 spacecraft for Sun and solar-earth link studies; 1 spacecraft for Moon exploration, single small spacecraft and life-science research spacecraft;

- Russian Segment of the KOSPAS-SARSAT International Search and Rescue System which comprises 2 spacecraft;
- ISS RS which comprises 8 modules;
- Space facilities for technological purposes which comprise 1 spacecraft and single spacecraft with reduced operational lifetime

Sources and Volume of Financing for the Program

Program milestones are achieved due to financing provided by the federal budget- 305 billion roubles, and involvement of the off-budget funding of 181,81 billion roubles. Underfunding of the work performed under the off-budget funding shall not cause additional commitments for the federal budget and federal executive authorities

Description of the issue to be solved by the Program

The Address of the President of the Russian Federation to the Federal Assembly of the Russian Federation defines such national objectives as doubling internal gross product within 10 years, enhancement of the people prosperity and maintenance of the national security. Thus, the strategic goals of the Russian Federation are the following:

- Enhancement of the people`s life quality;
- Maintaining high rates for stable economical growth;
- Creating potential for further development;
- Increasing the level of national security.

State priorities, including priorities in the space activities carried out on the basis of space high-technologies, shall be the subject for achieving these objectives.

Space exploration and research, including exploration and research of the Moon and other space objects, have the highest national priority in the Russian Federation (The Act on Space Activities of the Russian Federation).

The primary directions of the space activities in the Russian Federation are defined in “The Basic Trends of the Space Activities in the Russian Federation for Period up to 2010” and “The Basic Trends of the Military and Technical Politics in the Russian Federation for Period up to 2015 and Further” approved by the President of the Russian Federation on February 6, 2001, and March 11, 2003, accordingly.

The high-priority trends of the space activities which contribute to achieving the strategic objectives are the following:

- Environmental monitoring, control of critical emergencies and ecological accident management, exploration of the Earth natural resources;
- Support of satellite communication and broadcasting over entire territory of the Russian Federation, including satisfaction of the state`s needs in providing the people with the socio-oriented set of TV programs, maintenance of the President`s, Government`s and special communication; maintaining communication for the benefits of the federal executive authorities, executive authorities of the subjects of the Russian Federation and local managing authorities, as well as for the benefits of state defense, security and legal order control;
- Providing federal executive authorities, executive authorities of the subjects of the Russian Federation and local managing authorities with geophysical, including hydro-meteorology, data;
- Accomplishment of space projects aimed at enlarging the knowledge about the Earth, the Solar system and the Universe, implementation of fundamental space research in the fields of astrophysics, planetology, solar physics and solar-earth links studies;
- Maintaining equal-rights involvement of the Russian Federation in the international space programs and projects, with the purpose to have guaranteed access to the final outcome of these programs (projects);

- Carrying out orbital crew missions for the benefits of economical, scientific, application applied research enhancement;
- Validation of new and high-pure material production space technologies.

Significant augmentation of the needs for the space technologies and services in the socio-economical sphere, science and international cooperation, is expected through 2015. Unified informational network of the state, which includes up to 650 fixed-communication and broadcast links (currently-280), will be utilized widely. State needs within this period will increase from 40 (currently) to 120 links in different frequency ranges, the requirements to the signal power will grow up as well. Significant growth of the needs for mobile and personal communication, direct TV- and RF-transmission services will occur. The observation, monitoring and control data relay services will be still required for controlling automatic spacecraft, crew space facilities, including the International Space Station.

In order to provide valid weather predictions and to solve other hydro-meteorology tasks, it is necessary to provide an opportunity to maintain global atmospheric and underlying surface observation in the close-to-real-time manner.

In order to monitor emergencies and accomplish the most recent natural-resource-related objectives, it is necessary to provide the Earth-observation capability over the territory which covers 20 - 30 mln sq km (territory of Russia and neighboring zones of economical interest). Some regions are to be observed with periodicity from 3 hours to 1 day and with resolution of 1-5 m. Taking into account commercial and economical interests of the Russian Federation, overall area covered will enlarge up to 50 - 70 mln sq km by 2015; the resolution will be maintained at the level of 1 - 5 m and periodicity for some regions wrt real time scaling will reach up to 1 day. Specific importance is assigned to predicting industrial and natural emergencies. Space technologies shall serve to support permanent ecological monitoring of the territory of the Russian Federation, as well as status control of the high-priority objects.

International commitments of the Russian Federation regarding KOSPAS-SARSAT International Search and Rescue system shall be accomplished; KOSPAS-SARSAT effectiveness has been confirmed by its multi-year practical utilization.

Within the period up to 2015, in order to accomplish the goals of the Fundamental Space Research Program, developed by the Russian Academy of Sciences, it is necessary to satisfy the needs of the national scientific institutes regarding observation data to be applied for astrophysical objects, planets and solar studies; "space weather" prediction and immediate monitoring; invention of new power sources; space accident cautioning; geophysical phenomena prediction; exolife searching.

Within the same period, it is also necessary to maintain carrying out the space experiments with human involvement, in order to expedite validation of new- generation space technologies, to study processes` physics and to arrange: production of the materials and biopharmaceuticals which possess the features unachievable on the ground, development of the technologies and engineering equipment to support human missions to the planets in the Solar system, as well as accomplishment of the international commitments undertaken by the Russian Federation under the International Space Station program. Smooth space access from the territory of the Russian Federation shall be maintained.

The basis for space activities is laid by the Russian space systems, development and enhancement of which accelerates stabilization process for the economy, provides effective evolution of the science, technology and social sphere, consolidates defense power of the country. If the state's needs in space systems and services are not satisfied by creating and developing Russian space systems, then these needs are to be satisfied by procurement of the services in the world market; this will demand significant economical expenses, essentially decrease the capabilities for innovative evolution of the national economy, enlarge the gap between the Russian Federation and the most developed countries of the world in the post-industrial society.

Accelerated development of the Russian space systems will promote achievement of the goals on doubling the state's internal gross product within 10 years defined by the top-leaders of the country. The doubling shall occur, primarily, in the machine-building branch, including rocket and space industry; also, as defined by the Russian leaders, transition to the innovative evolution way of the economy, resolution of the social construction and state management problems, enhancement of the competitiveness for the space systems and services in the internal and world markets shall occur. The latter is very important, especially in front of further entry of Russia into the World Trade Organization.

Evolution of the Russian space systems allowed to increase the volume of external trade turnover and improve the quality of Russian involvement in the international trading processes; to utilize the competitive advantages in exporting knowledge-intensive products; to improve security and social stability; to increase the level of application for the scientific achievements in production process (innovations in the Russian organizations and development of the state-private partnership). Space activities of the Russian Federation are on the leading edge of the world space business; thus, these activities provide the opportunity to reduce the gap between the Russian Federation and the most developed countries of the world (establishment of the modern post-industrial society) and aimed at the most complete satisfaction of the information and service needs of the federal executive authorities, executive authorities of the subjects of the Russian Federation and local managing authorities, organizations and people of the country, provided only by the space systems.

However, due to negative economical conditions formed at the end of the 20th century, further development of the Russian space systems is now linked with resolving the following problematic situation. Russian orbital constellation of spacecraft intended for scientific and socio-economical objectives, except communication and broadcast satellites, is under the required level of evolution, which is to be maintained to complete accomplishing the tasks for the benefits of the socio-economical sphere, science and international cooperation.

Within last 10 years, the number of satellites in the Russian orbital constellation became 1.5 times less; at the same time, the number of satellites in the foreign constellations increased twice, and the tendency for them to enlarge further is still kept, in response to the constantly increasing needs for space systems and services in the world society.

In accordance with Resolution № 626 of the Government of the Russian Federation dated Aug. 25, 2001 named «About the State Support for Maintaining Deployment and Functioning of the Civil State Communication and Broadcast Satellite Systems», new spacecraft of the Express-A series, as well as spacecraft of next generation of the Express-AM series, were developed and commissioned to replace obsolete spacecraft of the Horizon series. Thus, the state's objective which covers maintenance and supporting stable functioning of the orbital constellation for socio-economical purposes was accomplished; these satellites are intended to provide federal TV- and radio- program broadcasting for all the Russian territory, as well as acquisition of these programs in Russian embassies abroad, arrangement of the mobile President's and Government's communication, international, inter-city, zonal and local satellite communication, development of the authority's satellite communication networks, including the ones for security agencies, and providing Internet access through small ground stations in remote or hardly-accessible regions of the country. The objectives of Federal Special Program «Electronic Russia (2002 – 2010)», which covers communication recovery in the Chechen Republic, replacement of the Sever RF-relay link by satellite systems, have been achieved; the conditions for accomplishing the other governmental and commercial tasks have been created.

Due to governmental support provided for deployment and functioning of the civil state communication and broadcast satellite systems, orbital frequency resources and united informational network of the country were maintained. At the same time, orbital constellation is to be further enlarged and renewed in response to growing demands for the scope and quality of the communication and broadcast services; the enlargement is to be provided on the basis of advanced long-term spacecraft and modern telecommunication technologies.

Currently, there is a lack of the Earth remote sensing orbital systems in Russia; thus, the opportunity to solve nature management, hydrometeorology, and emergency monitoring tasks is reduced.

Russian orbital constellation of the scientific spacecraft is represented by a single spacecraft, the life-time of which is almost over; thereby, the limited opportunity to study the Sun, planets of the Solar system, solar-earth links and near-Earth space results in negative effect for informational support of the Russian scientific institutes and causes degradation of these institutes.

Russian spacecraft developed in the past do not possess the required parameters wrt active lifetime, capabilities of the utilization payloads, throughput and data channel rates, as well as the opportunity to process the data on-board the spacecraft autonomously. Quality indexes and factors of the ground client's equipment are also under the current required levels.

Within the past 40 years, Russia cumulated unique experience in human space missions, including the outcomes resulted from the operations of the Mir station within 15 years. However, in the recent years, Russia deals only with transport services for the International Space Station. Development of the ISS Russian modules and scientific equipment for them has almost stuck. At the same time, real ISS operational time is limited to 2018 – 2020. The USA and the ISS partners are planning to complete ISS USOS assembly in 2010, and to commence effective scientific utilization from that time, thus intending to justify the station expenses by the scientific results achieved. The USA, European countries and China significantly expedite the work regarding preparation of the human missions to the Moon, Mars, and further exploration of these space objects. The technologies developed as an outcome of this work will have breakthrough character. Thus, in the current situation we may lose our priorities in the human space activities, and in addition Russia may fall behind in neighboring areas of science and technology.

Evolution of the modern Russian industry demands new materials and biopharmaceuticals with unique properties. These development technologies need exclusive environment which can be reproduced only in space. However, creation opportunity of such technologies is limited due to insufficient quantity of the space experiments carried out currently.

Nowadays Russian space launch vehicles (LV) are the most reliable in the world. Though most of them use toxic propellant components, and may be banned.

Furthermore, average cost of the Russian LV services will become comparable wrt the foreign launch services, and this threatens Russia to lose its position the world launch market.

Space equipment and technologies shall evolve in 2006 – 2015 on the basis of wide-range application of the information and nano-technologies. This would require modern equipment involved in the technological cycle and capable of materializing up-to-date technologies. Initial steps on this way are to cover technical retrofitting, introduction of new knowledge-intensive technologies, quality enhancement and renewal of scientific and R&D personnel.

Ground-based space facilities, including space ports, ground control stations, data acquisition stations, experimental facilities for rocket and spacecraft ground tests, are to be upgraded and retrofitted.

The current status of Russian space assets causes gradual deceleration of the Russian Federation in the space activities wrt the leading world space countries and prevents the country from satisfying the internal needs by the Russian means.

If no adequate measure is implemented, this process may become irreversible and turn into a drag for accelerated evolution of the engineering and economical potential of the country.

Weakened presence of the Russian Federation in space will cause unavoidable violation of the international commitments, primarily with the CIS states, European countries, the USA, China, India and other states, thus providing negative effect on the international prestige of the Russian Federation.

Accordingly, the problem to be solved by the Russian Federal Space Program for 2006 – 2015 is the following: development and evolution of the Russian space civil and dual-use technologies which are to satisfy the space communication and broadcasting needs in socio-economical sphere, science, international cooperation, defense and state security; acquiring meteorological and remote sensing data; needs in the results of fundamental space research; the information used for rescuing the objects in emergency; enhancing the achievements of the human space exploration; validation of the new and high-pure material production space technologies; implicit fulfillment of the international space commitments of the Russian Federation.

The problem resolution is to be accomplished on the level which provides achievements of the national strategic goals.

System of the Programmatic Actions

The Programmatic actions include the steps funded by the state budget, and the steps financed by the funds contributed into space programs by the non-governmental entities.

The actions funded from the budget include the work to be performed within the following sections:

- section I – «Scientific research and development activities»;
- section II – «Procurement of serial space products in order to maintain proper functioning of the required structure of the spacecraft constellation, provide accomplishment of R&D objectives, as well as control of the operating spacecraft»;
- section III – «Maintenance of the ground-based space infrastructure»;
- section IV – «State capital contribution for reconstruction, retrofitting of the industrial entities and evolution of the ground-based space infrastructure elements».

Section I intends carrying out the work under the following 11 subsections.

Subsection «Space communication, broadcast and relay systems» implies measures aimed at developing:

- Space complexes for the fixed communication, mobile President's communication and TV-radio-broadcasting systems;
- Multifunctional space relay system;
- Multifunctional personal satellite communication and data transmission system;
- Integrated engineering system for experimental validation and tests of the new satellite communication and broadcast technologies;
- Space system for digital radio and TV-broadcasting from the spacecraft in high elliptical orbit.

Subsection «Earth remote sensing, hydrometeorology observations, ecological monitoring and emergency control» implies measures aimed at developing:

- Geostationary and low-orbit space facilities and systems of new generation for hydro-meteorology support and prompt monitoring of earthquakes, industrial and natural emergencies;
- Opto- electronic space facility for studying natural resources of the Earth; development of the space system on the basis of this opto- electronic space facility;
- Radar space observation system, as well as integrated Earth remote sensing satellite system;
- Advanced multifunctional system and Earth remote sensing space data acquisition, registration and processing ground centers;
- Complexes of under-satellite validation observations, data bases and distribution technology for space data;
- On-board payloads for the Earth remote sensing satellites.

Subsection «Space systems for fundamental space research» implies measures aimed at developing:

- Space observatories for studies of the Sun and space rays, as well as for observations of the astrophysical objects in different ranges of electromagnetic spectrum;
- Astrometry space system aimed at obtaining data about locations and motions of the stars;
- Space systems and devices for Phobos, Mars, Venus, Moon exploration programs, including international projects;
- Space system for space biology and medicine research activities;

Subsection «Russian segment of the KOSPAS-SARSAT International Search and Rescue System» implies measures aimed at developing a satellite system of new generation, which supports search and rescue of the marine, air and ground objects sustained an emergency; the system is featured by high precision in positioning the object's coordinates, promptness in emergency message acquisition and high throughput.

Subsection «Human flights» implies measures aimed at further development of the ISS Russian Segment; development of a reusable crew space vehicle of new generation; development of scientific, engineering and technological basis and validation of the key elements of the advanced systems for crew programs; development of basic elements for human expeditions to Mars.

Subsection «Space technologies» implies measures aimed at developing space complexes for space microgravity technological and biotechnological research.

Subsection «Launch vehicles» implies measures aimed at developing rocket space facility of new generation- heavy-lift Angara LV, high-effective upper stages for light, medium and heavy-lift launchers, advanced reusable liquid rocket engine, as well as upgrading of the current LVs due to new technologies and EEE-parts.

Subsection «Objects of the space ports and ground experimental facilities» implies measures aimed at:

- Modification and resource restoration of the technical and supporting Baikonur facilities;
- Development of the ecological monitoring system for the territories impacted by the rocket and space elements;
- Upgrading of the rocket and spacecraft experimental and test facilities.

Subsection «Control systems of the scientific and socio-economical spacecraft» implies measures aimed at:

- Evolution of the ground automatic spacecraft control and measurement objects and systems;
- Development of the command-measurement and telemetry system of new generation;
- Modification of the scientific and socio-economic spacecraft mission control center;
- Development of the unified onboard integrated data and telemetry system of new generation for advanced and modified LVs and spacecraft.

Subsection «Advanced basic products, technologies and support of the rocket and spacecraft reliability» implies measures aimed at:

- Development of new technologies for design and manufacturing, as well as development of the basic elements of rockets and spacecraft;
- Development and enhancement of the metrological systems to support development, production, operations and disposal of rockets and spacecraft;
- Development of unified sets of intellectual sensors, new design and functional materials, measurement, monitoring, diagnostics and emergency protection systems for the rockets and spacecraft, ground technological objects;
- Increasing the reliability of the operating space facilities, launchers and their components;
- Modification of the components, devices and units of the operating spacecraft and rockets by using new generation of EEE-parts and materials;

- Development and commissioning of the hardware and software facilities to be applied for math-modeling approach to validation and tests of rockets and spacecraft;
- Development of new special structure materials;
- Development and enhancement of the onboard and ground encryption protection for socio-economical spacecraft control loops;

Subsection «System studies and applied scientific and research activities» implies:

- Integrated system studies of the space scientific and technical problems and development of the proposals on evolution of the Russian space potential up to 2015 and further, taking into account opportunities provided by the state economy;
- Studies aimed at defining engineering design of the advanced space facilities and systems for various purposes, development of new technologies for utilization purposes;
- Searching the ways to enhance the level for engineering and operational characteristics, to provide reliability and effectiveness of the space systems;
- Research aimed at providing laying the advanced R&D, production and technological basis for material/coating development to be used in advanced rockets and spacecraft;
- Development and introduction of the advanced ITs, occurred during spacecraft and rocket design activities and production management;
- Development and justification of the planning documentation for the upcoming program period.

In accordance with section П, procurement of spacecraft, launchers, upper stages and other space products is intended; in addition, it is planned to maintain proper control of the spacecraft accepted for operation.

In accordance with section III, it is intended to conduct the activities aimed at providing technical and operational readiness of the technological and support facilities at the Baikonur space port, at Gagarin Cosmonaut Training Center, as well as at the other objects of ground-based space infrastructure, in order for those to be ready to accomplish the set-up objectives.

In accordance with section IV, it is intended to fulfill the milestones of the first stage (2006-2008) regarding reconstruction and technical retrofitting of the industrial entities and development of the objects of ground-based space infrastructure.

The space activities to be implemented under the funding invested by non-governmental customers include the work in the following areas:

- Communication, broadcasting and relay spacecraft;
- Earth remote sensing, hydro-meteorology observations, ecological monitoring, emergency control;
- Launch vehicles;
- Objects of the space ports and ground experimental facilities.

The outcome of the work defined above is planned to be used in order to accomplish the objectives which cover state needs.

Estimation of the Socio-Economical and Ecological Effectiveness

The following outcomes are to occur as a result of the Program milestones accomplishment:

- 1) development, modification, commissioning of the space systems and facilities of new generation are to be completed. This includes:
 - a) increasing the throughput for the route, inter-zone, local, corporative, agency communication networks; enhancing the capacity of the TV and radio- signal distribution networks, thus providing the required scope and defined quality level for the following: global, real-time, stable, absolutely secure President's and Government's communication;

needs for modern telecommunications, including confidential communications, of the federal authority organs, executive authority organs of the subjects of the Russian Federation and local management authorities;

user needs for modern communication types in all regions of Russia, including low-populated and remote ones;

land, marine and air user needs for global communication with low-mass and small-dimension terminals for multiple clients, which meet modern requirements to the type, quality and scope of services defined by the international standards;

б) increasing periodicity of hydro-meteorology data updating up to 3 hours for medium-altitude spacecraft and up to real-time level for geostationary satellites. This will provide the opportunities:

to acquire data used for high-quality short-term (up to 3-5 days) and long-term (up to 15 days and more) weather forecasts;

to detect promptly (about 0,5-1 days) catastrophic phenomena and emergencies (earthquakes, mudflows, snowslides, floods, biosphere pollutions, damages of oil or gas pipelines, etc.), to warn timely about emergencies, forest fires;

в) increasing resolution of the Earth remote sensing spacecraft (up to 1m), enlarging the number of the observation spectral ranges (up to 1000), increasing the periodicity of the Earth observation sessions (up to 8 hours). This will provide the opportunities:

to satisfy the needs for the Earth remote sensing data in mapping, utilization of the North marine route, geological studies of the Russian territory, inventory of the agricultural and forest areas, development of land registries, monitoring of the hazardous anthropogenic impacts on the environments;

to satisfy the Earth remote sensing data needs of the Russian regions on the required level;

г) 11 national projects have been completed; involvement in 5 international projects was provided; these projects cover development and operations of the astrophysical object observation instruments for X-ray, gamma- and RF-ranges with high resolution, instruments used to study solar-Earth links, equipment used to deliver planetary substances to the Earth, as well as research instruments for Mars, Moon and other objects of the Solar system. This will provide:

Russian scientific institutes with necessary data for fundamental and applied scientific research including samples of extra-terrestrial substances (Phobos soil);

Population of all Russian regions with the "space weather" prediction data and data about Solar and Earth magnetosphere phenomena which can cause negative effect for their health;

д) space system with small spacecraft which is to be used to position the objects in emergency with high precision; rapid acquisition (up to 10 sec) of emergency messages and positioning precision up to 100m for the objects in emergency have been provided;

е) assembly of the ISS Russian segment have been completed; long-term scientific and applied research program for the experiments to be conducted in the ISS Russian segment have been implemented; technological, scientific and technical bases for the human flights, including Mars missions, have been laid;

ж) automatic spacecraft for technological purposes have been developed; this spacecraft is serviced from the piloted station; the spacecraft provides validation of the basic material production technologies, including production of organic and biopharmaceuticals with the parameters unreachable in the ground conditions;

з) operational time of the basic Soyuz and Cosmos-3M rocket systems have been extended due to their upgrading; new-generation rocket and space complex Angara, which uses ecologically-clean propellant components, has been developed; construction of the launch and engineering facilities for these rockets has been completed; high-effective upper stages have been developed; average cost of launch services has been reduced; mass of the payload to be put into geostationary and other orbits has been increased.

2) Effectiveness of spacecraft and crew vehicle control has been enhanced due to development and evolution of the ground automatic control complex on the basis of contribution; new efficient spacecraft control technologies have been developed and introduced; spacecraft control expenses have been decreased;

3) Key issues regarding evolution of space activities have been studied; advanced scientific and technical, technological bases have been laid for the branch of basic technologies, crucial elements of the space systems and various facilities; R&D and system research activities have been conducted in the branch of rocket and space systems;

4) Spacecraft active operational lifetime up to 15 and more years are maintained; radiation- and disturbance- tolerant long-functioning service and utilization spacecraft payloads have been developed; micro- miniaturization of the service and utilization spacecraft systems have been achieved, Russian contribution into the spacecraft equipment have been increased up to 90 percents;

5) Marketing of the Russian space systems in such perspective sectors of the world market as communication, broadcast, Earth remote sensing, have been provided.

Estimation of the number of work positions shows that the Program shall lead to stabilization of the manpower potential for the specialists in the rocket and space industry; 250 thousands of work positions with up-to-date technological instrumentation are kept.

Assessment for the accomplishment degree for the ecological issues shows that the Program shall result in practical resolution for the ecological problems. Termination of Proton operations, as well as the operations of the other launchers developed on the basis of conversion intercontinental ballistic missiles, transition to the launchers which use ecologically-clean propellant components, soil recultivation, water purification, development of ecological monitoring system, maintaining ecological security by reducing the nomenclature of the LV in operation from 10 to 4, combining the regions impacted by falling LV parts, application of flexible LV flight control programs, reducing the volume of propellant the waste stages, in ecological studies of these regions, space ports and technological facilities, shall result in preventing pollution of the fields by the falling LV stages and pollution of the test facilities by the toxic propellant components. Overall square of the land allocated as LV stage falling zone will become 40 percent less.

Economical effect assessment for the socio- economical and scientific outcome of the space activities shows that the Program shall be resulted in the predicted total economical effect in 2006 – 2015 is to be on the level of 500 billion roubles (in 2005 cost level).