

**THE PROGRAMS, PROJECTS AND CONTRACTS' STATUS
IN THE SPACE RESEARCH INSTITUTE
AT THE BULGARIAN ACADEMY OF SCIENCES**

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It has become a tradition for me to deliver a plenary report at the international scientific conference organized by the SRI, which appears to render an account of the Institute's overall activity during the elapsed one-year period. In our case, this period is characterized most of all by the continuing projects along the Institute's traditional lines:

- Space Physics;
- Remote Sensing of the Earth from Space;
- Aerospace Technologies.

The first field boasts quite topical projects, such as: *Fototok* and *JET*, implemented jointly with our colleagues from the SRI-RAS; *Shuman*, *Folna-R* and *Aurora*, implemented jointly with IZMIRAN-RAS. All of these projects are related with the study of the ionosphere and magnetosphere and the detection of processes and phenomena related with earthquake forecasting. This field also features a project with the CNRS dedicated to experimental studies of ionospheric effects above seismic areas by data from the French satellite DEMETRE and the American satellite DMSP. Works are ongoing successfully under the *Obstanovka* Project intended to measure the electric potential of the modules on the International Space Station with specialists from Russia, Hungary, Poland and more. The test and flying specimens are finished and final tests are forthcoming before their launching into orbit.

In the field of Astronomy, the Institute participates with 2 projects. Jointly with scientists from USA, Russia and Italy, data from the Chandra (NASA) and XMM-Newton (ESA) X-ray Observatories are processed and theoretical models are developed. The second project is related with studies of accretion disks which are carried out jointly with our colleagues from the Institute of Astronomy at the RAS. The *Chaos-Solaria* Project with the SRI-RAS is continuing for studying non-linear dynamics and chaos in space plasma.

The Remote Sensing of the Earth research line was well presented during this period by projects focused on development of models based on space and ground-based observations jointly with specialists from the *Aristotle* University, Greece, development of fundamental ecological planning methods using geoinformation technologies under a contract with the Ministry of Education and Sciences of the Republic of Bulgaria. The environmental studies along the course of the Mesta River based on space images and ground-based measurements are also continuing under a contract with the MES. Geological studies and risk assessment for natural phenomena are carried out under a contract with the Institute of Geology at the RAS. The applied projects related with monitoring the air pollution of the Town of Stara Zagora and the development of the project for the water basins in the Toundzha Municipality also contribute greatly to the implementation of remote sensing methods in favour of the people inhabiting these regions. The project for studying electromagnetic pollution under the 7th EU FP jointly with specialists from Macedonia, Slovenia and Croatia is of interest, too.

The *Svet* Space Greenhouse is being improved under the non-currency exchange program jointly with specialists from the IMBP-RAN to provide for Bulgaria's participation in the 500-day ground-based experiment in preparation of a mission to Mars. Work under the *Mioneurolab* Project related with Space Medicine based on the multi-annual experience accumulated on board the Mir Station using the *Neurolab-B* equipment is also underway.

The Institute continues its successful participation in the field of Space Material Science and Nanotechnologies. SRI is member of the European incubator ESINET. Under European projects (*X-Gear*, *NAVOBS*, *I-Stone*, *NAVOBS+*), instruments and other articles of various function are being developed, based on nanostructures obtained by explosion technologies.

The project for special tribologic materials developed jointly with specialists from Ukraine was admitted to the SURE Programme under the 6th EU FP. The SRI participated in the 6th EU FP also with the *Schema* Project aimed at analyzing the processes and phenomena triggering tsunami.

The *Resonance* Project with the SRI-RAS for complex navigation of high-apogee satellites is ongoing, too, notwithstanding the certain delay in the deployment of the *Galileo* Global Navigation System.

One of the most prospective projects of the Institute, *BalkanSat*, is embarking on its decisive phase and, provided State funds are allocated, it is going to be the major project in the couple of years ahead. So far, the major characteristics and parameters of the satellite have been determined as well as the payload.

The reported period is of historical importance to Bulgaria in relation with signing the contract for its full-member participation in the European Union, which unveils new prospects for Bulgarian science and space studies in particular. It resulted in significant increase of the SRI's projects under the European Programmes, as evident from the enclosed Projects List of the Space Research Institute during the Period 2005 - 1007.

1	<p>Photocurrent – Probe methods for study of the ionosphere: research of polar areas by data from the Intercosmos-Bulgaria-1300 satellite, 2006-2008.</p> <p><u>St. Chapkanov</u></p>
2	<p>Research of ELF/ULF waves in the Earth's magnetosphere <i>Processing of all ELF electromagnetic measurements of the Magion-5 satellite and data base creation including relevant measurements from the Magion-4 satellite as well as ground-based measurements – contract with the Czech Republic</i></p> <p><u>D. Teodossiev</u></p>
3	<p>Blast waves physics in astrophysical objects. <i>Work on the subject done in cooperation with scientists from USA, Italy and Russia using data from the Chandra (NASA) and XMM-Newton (ESA) X-ray observatories. Theoretical models are also developed.</i></p> <p><u>Sv. Jekov</u></p>
4	<p>Contract No. H3-1402/04 with the Ministry of Education and Science, Scientific Research Fund, on the Topic: Electromagnetic Monitoring of Regions with Enhanced Seismic Activity (Measurement Equipment Installed at the Panagyurishte Geomagnetic Observatory)</p> <p><u>B. Boytchev</u></p>
5	<p>Chaos-Solaria Project: Study of Non-Linear Dynamics and Chaos in Space Plasma and Geophysical Processes, 2007-2010 <i>Contract under the Equivalent Non-Currency Exchange between SRI-BAS and SRI-RAS, Cosmogeophysics Department</i></p> <p><u>St Lukov</u></p>
6	<p>Project for Joint Scientific Research on the Topic: Development and Testing of New Tribotechnical Materials with Ecologic Antifriction Component, 2006-2009 <i>With the National Academy of Sciences of Ukraine (Equivalent Non-Currency Exchange).</i></p> <p><u>Yu. Simeonova</u></p>
7	<p>Implementation of the Work Program of the Third Phase of the Contract КИ-1-01 from 2003 of SRI-BAS with the Ministry of Education and Science under the <i>Space Studies</i> Research Line for Designing Svet-3 Space Greenhouse on the Topic: Designing of a New Control System for a Space Greenhouse. Experimental Testing of Mathematical Models of Transfer Processes in Substrate Media</p> <p><u>T. Ivaniva</u></p>
8	<p>Implementation of Contract with ИМБП–RAS from 2005 on the Greenhouse-Mars Project under the Bilateral Scientific Collaboration for Fundamental Space Research under Equivalent Non-Currency Exchange between BAS and RAS until 2010 on the Topic: Study of Some Key Technologic Problems with Plant Breeding during the 500-Day Ground-Based Experiment in Moscow for the Purpose of Creating the Biological Unit of the Life-Provision System during a Manned Mission to Mars – Design of a Principally New Illumination Block Based on LEDs</p> <ul style="list-style-type: none"> • Simulation of a crew's mission to Mars; • 6 volunteers will be closed for a period between 500 and 700 days; • Stock of 5 t of food and oxygen and 3 t of water; • The psycho-physiological stress from continuous isolation will be studied; • A greenhouse with area of 3 m² will be used. <p><u>T. Ivanova</u></p>

9	<p>MIONEUROLAB Project Study of Weightlessness Effects on the Central Motor Regulation Mechanisms and the Biophysical Properties of Skeleton Muscles</p> <p>A program module for grouping of identified camera extrasystoles during continuous 24-hour ECG Record has been developed. A software module for frequency and wave analysis of cardiac rhythmogram has been developed. A stress-test program module has been developed accounting for the S-T segment level in an ECG</p> <p><u>P.Genov, S.Tanev, Pl.Trendafilov</u></p>
10	<p>Under the project Experimental Study of the Ionospheric Effects over Seismically Active Regions by Means of Coordinated Ground Based, Demeter and DMSP Satellite Data between SRI-BAS and CNRS (Centre National de Recherche Scientifique)- France, a common data base from DEMETER micro satellite and DMSP (Defense Meteorological Satellite Program DoD USA) satellites was created in our Institute. While DMSP data set use a "standard string record" with geophysical and plasma parameters merged to 4s step in Universal Time (UT), DEMETER probe instruments operate with different time/space resolution in "burst" and "survey" modes of telemetry. In fact, we created two different types of databases software addressed to serve these two types of inflow dataset.</p> <p><u>L. Bankov</u></p>
11	<p>Conducting a Pilot Monitoring Study of the Territory of the Toundzha Municipality Based on Satellite and GPS Data from August 2006 to September 2006 Inclusive.</p> <p>Contract No. 76/08/2006 between the Toundzha Municipality and SRI-BAS;</p> <p><u>R. Nedkov</u></p>
12	<p>Conducting an Internet-Based Monitoring Study of the Atmospheric Pollution in the Region of the Stara Zagora Municipality Based on Satellite and Ground-Based Data.</p> <p>Contract between the Stara Zagora Municipality and SRI-BAS, 2005–2007,</p> <p><u>L. Filipov</u></p>
13	<p>I-Stone Project: Creation of new generation tools based on nanotechnologies – EU</p> <p><u>S. Stavrev</u> http://www.navobs.com</p>
14	<p>X-Gear Project: Creation of new generation diamond ropes for stone cutting – EU</p> <ul style="list-style-type: none"> The objective of X-Gear is the diffusion and standardisation of novel technologies and new materials for a new generation of gears characterised by higher accuracy, resistance, reliability, and tribology properties. In this context, X-GEAR plays a role in the competitiveness of European industry since it aims to comply with the increasingly tighter requirements being placed on the gear industry for lighter weight, higher torque transmissions and quieter, more efficient gear trains. <p>Manufacturing and design tools and knowledge platform implementing guidelines and best practices developed in the project, for a wider diffusion of the project results to the IAGs and their members.</p> <p><u>S. Stavrev</u> http://dappolonia-research.com/xgear</p>
15	<p>ESINET Project: Creation of European space sources net – EU</p> <p><u>S. Stavrev</u></p>
16	<p>NAVOBS Project – FP6: Creation of firms net for introduce developments in 18 areas of space research.</p> <p>The NAVOBS^{PLUS} programme is an initiative of the European Space Incubator Network (ESINET), supported by the European Business and Innovation Centre Network, the European Space Agency and the Space Sesearch & Applications Unit of the EC DG Enterprise and Industry.</p> <p><u>S. Stavrev</u> http://www.navobs.com</p>

17	<p>Accretion – Non-linear dynamics of accretion flows in twin stellar systems, 2006-2010 – Russia</p> <p><u>L. Filipov</u></p>
18	<p>Balkansat – Development of microsatellite platform for scientific research, 2006-2010 – Russia and Balkan countries</p> <p><u>P. Getsov</u></p>
19	<p>Jet – Space-temporary characteristics of the polar jet in the subauroral area during the simultaneous observations of the Intercosmos-Bulgaria-1300, ARIEL-3, DE-2 satellites and Yakutsk ground ionoprobes chain, 2006-2007.</p> <p><u>L. Bankov</u></p>
20	<p>Wave-R - Research of electromagnetic waves and resonance processes of energy transportation in ionospheric-magnetospheric plasma by the results of high apogee satellites measurements, 2006-2010.</p> <p><u>B. Boytchev</u></p>
22	<p>Charge-ISS – Charge research of space device with extralarge dimensions – International Space Station (ISS) in ionospheric plasma interaction, 2006 – 2010 – Russia, Hungary, Poland etc.</p> <p><u>G. Stanev</u></p>
23	<p>SCHEMA – Scenarios for Hazard-Induced Emergencies Management. Sixth Framework Programme.</p> <p><i>In the autumn of 2007, a contract with more than 12 partners from 9 countries of the Mediterranean Region will be signed.</i></p> <p><u>P. Getsov, G. Mardirosian, B. Rangelov</u></p>
24	<p>Designing a Geodatabase Model for the Purposes of Large-Scale Mapping of Land-Use Conflicts Caused by Mining Industry Using Remote Sensing and Ground-Based Data. Joint Research Project –No.P-16*24.04.07 between the Bulgarian Academy of Sciences and the Aristotle University of Thessaloniki, Greece, 2007-2009.</p> <p><i>The major objective of the project is to develop and approbate a geodatabase model for the purposes of large-scale mapping of land-use conflicts caused by extraction industry using geoinformation technologies. The designed model will be approbated on the territory of the land of the Novi Iskur District, Metropolitan Municipality, Bulgaria, and on part of the water-catchment of the Strouma River, northeast of Thessalonica, Greece.</i></p> <p><u>E. Rumenina</u></p>
25	<p>Geoecologic Studies of Hazardous Natural Processes Using Remote Sensing and Ground-Based Methods and Geoinformation Technologies, Contract between the Institute of Geoecology, Russian Academy of Sciences and SRI – BAS, 2005–2007.</p> <p><i>As a result of the Project's first phase completion, the methods for studying geomorphological complexes and hazardous natural processes, using geoinformation technologies and drawing geomorphologic risk maps have. A unified geodatabase model has been designed, including an aerospace component for studying geomorphological complexes and geoecologic monitoring of hazardous natural processes.</i></p> <p><u>H. Spiridonov</u></p>
26	<p>Study of Electromagnetic Emissions. Contract between SRI-BAS and the Research Centre „Sonchev Zrak”, Skopje, Macedonia. 2005-2007.</p> <p><i>Within the Contract's framework studies have been performed of the electromagnetic field created by power transmission lines and high-frequency communication equipment. With the participation of specialists from the National Institute of Hygiene, Medical Ecology and Nutrition, measurements of the electromagnetic field under a 400 kV/50 Hz power transmission line in the region of the Town of Prilep, Macedonia, have been made and expert assessment has been provided on the request of the Macedonian judiciary.</i></p> <p><u>G. Mardirosian</u></p>

27	<p>Geoecological Investigation of Natural Hazards and Integral Risk Assessment for the Needs of Management at a Regional Level. Contract № H3 1514/05 between the SRI-BAS and the Scientific Research Fund at the Ministry of Education and Science, 2005-2008.</p> <p><i>The major scientific objective of the contract is to develop methods for a complex study of the natural hazardous processes taking place within a given territory and drawing a map of the risk rate for the needs of a territorial unit's sustainable management. The studies are conducted in the Eastern Rhodopes, in the regions of the Municipalities of Kurdzhali and Dzhebel. Complex assessment of the Territory in GIS medium will be made and a detailed map of the great landslide at the Village of General Geshev will be drawn, using aerospace information.</i></p> <p><u>H. Spiridonov</u></p>
28	<p>Development of Methodical Fundamentals of Landscape-Ecological Planning Using Geoinformation Technologies. Contract NZ –No.1507/05 between the SRI-BAS and the Scientific Research Fund at the Ministry of Education and Science, 2005-2008.</p> <p><i>A GIS model for landscape-ecological planning at a municipal level has been designed and approbated. Using archive and modern aerial and satellite images featuring spatial resolution of less than five meters and data obtained from non-conventional information sources, a series of thematic maps have been drawn reflecting land-use condition and dynamics over a period of 65 years. As a result of the performed monitoring, landscape-ecological plan of the territory will be elaborated.</i></p> <p><u>E. Rumenina</u></p>
29	<p>Physico-Geographic Study of the Environment in the Basin of the Mesta River by Analysis of Remote-Sensing and Ground-Based Data. Contract MY H3-1202 between the SRI-BAS and the Scientific Research Fund at the Ministry of Education and Science, 2004-2007.</p> <p><i>During the Contract's implementation, an assessment was made of the rate of anthropogenic transformation of the landscapes in the upper part of the basin of the Mesta River. A complex of methods was applied for the purpose, the greatest emphasis being placed on remote sensing methods, landscape and landscape-geochemical methods. To assess landscapes' heave-metal loading, 115 samples were analyzed to identify the content of 6 elements (Pb, Zn, Cu, Mn, Cr, Cd). To perform area mapping of the anthropogenized landscapes, aerial photos were used, subject to preliminary processing to remove geometric deformations caused by relief and to improve their informativeness.</i></p> <p><u>A. Gikov</u></p>
30	<p>Studies Related with Integration of GPS and Loran-C to Determine Lateral Location and Perform Navigation Georeferencee. Project BAS.</p> <p><i>On maps in scale 1:100,000 and 1:200,000, the location of the ground-based stations of the LORAN-C system for the territory of the Republic of Bulgaria was identified. Terrain measurements are scheduled related with the distribution of the system's emissions for the purpose of navigation determination and georeference of movable and stationary ground-based objects.</i></p> <p><u>N. Georgiev</u></p>
31	<p>Preliminary Processing of Videospectrometric Data. Project BAS.</p> <p><i>Remote sensing system analysis has been made to localize, characterize and minimize the impact of error sources through preliminary processing of the data for the period from their acquisition until the information's receiving. The functional relationship between the radiation reflected by the studied object and the device's output signal has been determined.</i></p> <p><u>V. Atanassov</u></p>
32	<p>Development of Techniques and Instrumentation to Study the Total Content of Atmospheric Ozone</p> <p><i>Work is ongoing related with the design of optical, optico-electronic and electronic-optical equipment for civil and military use: satellite and ground-based spectrophotometer, collimator, autocollimator, collimator adjustment stand, sight-target etc.</i></p> <p><i>A major role here plays the equipment for measuring the total content of atmospheric ozone.</i></p> <p><u>J. Jekov</u></p>

33	<p>National System for Telemedicine <i>Personal Diagnostic Device</i> <i>Measures the following major physiological parameters:</i></p> <ul style="list-style-type: none"> - EKG I lead-out with record duration of 30 s, - blood saturation with oxygen, - bodily temperature, - arterial blood pressure, - etc. <p><u>P. Genov, S. Tanev, Pl. Trendafilov</u></p>
34	<p>Contract „System for early detection, announcement and localization of rising field and forest fires and floods on the territory of Republic of Bulgaria”</p> <ul style="list-style-type: none"> - Public Agency “Civil Protection” - Aviotechnics-Plovdiv <p><i>Finmechanics-Italia</i></p> <p><u>P. Getsov</u></p>
35	<p>Modernization of ground system for radiolocation surveillance in the NATO standards</p> <ul style="list-style-type: none"> - Ministry of Defence - Republic of Bulgaria - Bitova Elektronika – V. Tarnovo - EADS <p><u>P. Getsov, G. Sotirov, S. Avramov</u></p>
36	<p><i>Within the framework of EU program "SEE-ERA.NET" for finance of mutual scientific projects at the Western Balkan countries in environment area team of scientists from Bulgaria, Macedonia, Croatia and Slovenia proposed research project Development of strategy and methodic for EMP monitoring from natural and anthropogenic sources for Western Balkan area which was approved and financed by agreement "INTAS Ref. Nr 06 - 10374"</i></p> <p><u>P. Getsov, D. Teodosiev, G. Mardirossian, G. Sotirov, E. Roumenina</u></p>
37	<p>Center for transfer of aerospace technologies <i>PHARE project in collaboration with Geographical Institute – BAS, NPP “Cosmos”, New Bulgarian University</i></p> <p><u>P. Getsov, G. Mardirossian, I. Nikolova, O. Petrov, G. Sotirov, E. Rumenina, T. Belichinova</u></p>
38	<p>“ESA SURE ANNOUNCEMENT OF OPPORTUNITY - 2006” “Influence of the Space Environment on the Physical and Tribological Properties of Self-lubricating Composite Materials”. “ESA SURE AO - 003/24.04.2006”</p> <p><u>Yu. Simeonova</u></p>
39	<p>7 FP, Space objects protection from solid radiation <i>In collaboration with Valonia Space Logistics, Brussels</i></p> <p><u>S. Stavrev</u></p>
40	<p>7 FP, Covering of tools for processing of highcollegate steels <i>In collaboration with D’Appolonia Genua, Italy</i></p> <p><u>S. Stavrev</u></p>
41	<p>7 FP, Criogenetic reservoir based on matrix from thermoplastic composition <i>In collaboration with EADS Astrium, Toulouse, France</i></p> <p><u>S. Stavrev</u></p>