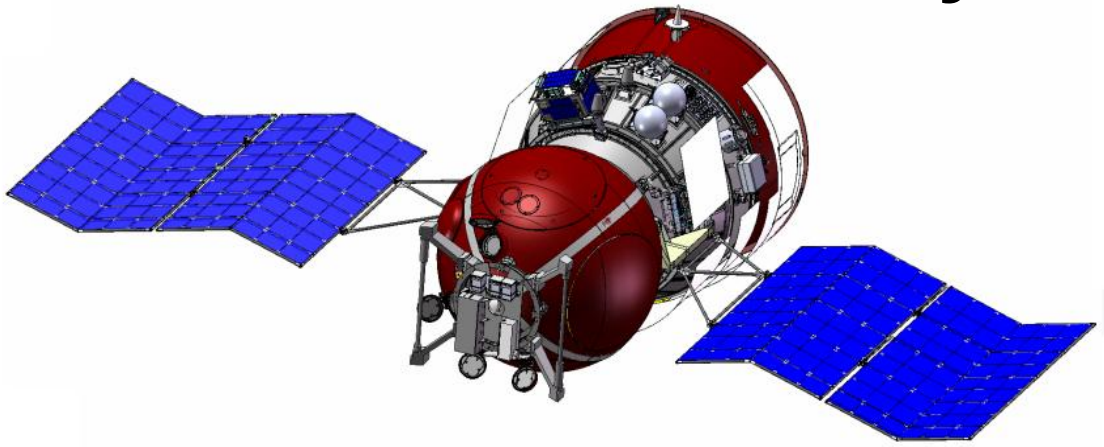
BION-M2: Scientific program

Space Biology, Medicine and Biotechnology Research: Russian Unmanned Spaceflights Scheduled for 2016 - 2025

Space vehicle	Years									
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
«BION-M» №2 «BION-M» №3 Flight – 30 days H=800-1000 km H=550 km							№2			№3
«Vozvrat-MKA» №1 Flight – 30-45 days H=1000-200000 km										№1

- Preparation - Flight - Lunch - Landing

BION-M No. 2 Project



Main task:

Comprehensive study of combined biological impact of increased space radiation levels and weightlessness on organism and its separate functional systems at te cellular and molecular levels.

Beginning of funding – **2015**

Planned launch date– **2022**

Flight duration– **30 days**

Orbital height– **800-1000 km**

The hardware will be analogous to BION-M1, but it will be modified based on the results of flight tests.

Bioobjects –C57BL/6 mice, insects, plants, cell cultures, microorganisms

РОССИЙСКАЯ АКАДЕМИЯ НАУК
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РЕШЕНИЕ

«29» января 2015 г. № 10310-05

г. Москва

«Об организации работ по комплексу научной аппаратуры КА «Бион - М» № 2»

1. Рекомендовать руководству Российской академии наук и Роскосмоса утвердить в установленном порядке головной научной организацией и разработчиком комплекса научной аппаратуры по программе «Бион - М» № 2 Государственный научный центр РФ – Институт медико-биологических проблем РАН (ГНЦ РФ - ИМБП РАН).

2. Рекомендовать ГНЦ РФ - Институту медико-биологических проблем РАН разработать и представить на рассмотрение в Совет РАН по космосу проект Программы научных исследований и экспериментов с использованием КА «Бион - М» № 2 на основе решения Совета РАН по космосу от 3 декабря 2014 г. № 10310-17.

Председатель
Совета РАН по космосу
академик Л.М. Зеленый

Ученый секретарь
Совета РАН по космосу
к.э.н. А.В. Алферов

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РЕШЕНИЕ

« 02 » апреля 2015 г. № 10310-17

г. Москва

«Рассмотрение предложений секции «Космическая биология и физиология» Совета РАН по космосу по составу Межведомственной комиссии по отбору экспериментов и исследований в проекте «Бион - М» № 2»

Заслушав и обсудив доклад д.б.н. Сычева В.Н. (заместитель директора Института медико-биологических проблем РАН) о предложениях секции «Космическая биология и физиология» Совета РАН по космосу по составу Межведомственной комиссии по отбору экспериментов и исследований в проекте «Бион - М» № 2» утвердить представленный проект с учетом высказанных на заседании предложений и замечаний согласно приложению.

Председатель
Совета РАН по космосу
академик Л.М. Зеленый

Ученый секретарь
Совета РАН по космосу
к.э.н. А.В. Алферов

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37 Technical Specifications for space experiments aboard BION-M2 from **23** RAS institutes, universities, and other research institutions submitted to the Interagency committee:

1. Institute of Biomedical Problems of RAS
2. Federal Research Center – Institute of Cytology of RAS
3. FSBRI – Institute of Fundamental Problems of Biology of RAS
4. FSBRI – Institute of Physicochemical and Biological Problems of Soil Science of RAS
5. FSBRI – Institute of Systems of Image Processing of RAS
6. FSBRI – Institute of Crystallography of RAS
7. FSBRI – Institute of Solid State Physics of RAS
8. Orenburg Research Center of Ural Branch of RAS
9. FSUE Special Design Bureau of the Institute of Radiotechnique and electronics of RAS
10. Biological Department of Lomonosov Moscow State University
11. State Research Institute of Genetics and Selection of Industrial Microorganisms
12. The All-Russian Research Institute for Optical and Physical Measurements Federal State Unitary Enterprise
13. Space Rocket Center “Progress”
14. Laboratory of Radiation Biology in Joint Institute for Nuclear Research ;
15. Tuscia University, Italy
16. Sapienza — Università di Roma, Italy
17. FSUE Branch - Center for Operation of Ground-based Space Infrastructure – Research Institute of Launch Facility
18. FSBRI Perm State National Research University
19. Institute of Space Instrument Engineering of the Korolev’s Samara State Aerospace University
20. Samara State Medical University of Health Ministry
21. FSUE “Samara Regional Center of Planned Parenthood and Reproduction”
22. Samara State University
23. FSBRI – Samara Research Institute of Agriculture

After review of the TS-SE:

27 + 3*) experiments and investigations have been included into the BION-M2 flight tests program,

6 experiments (3 + 3*)) and investigations have been included conditionally, and

4 experiments have been rejected.

The experiments and investigations during flight tests of BION-M No. 2 SV will be conducted in the following fields:

1. Experiments with animals - 3
2. Experiments with animals cell cultures
3. Experiments with plants, plant cells cultures, seeds, and algae – 6
4. Experiments with microorganisms – 4
5. Exobiological and astrobiological experiments – 4+1*
6. Radiobiological experiments and radiation studies – 1
7. Biotechnological experiments – 2
8. Investigations and experiments on space materials science 1+1*
9. Physical and technical experiments – 4+1*
10. Educational experiments – the program will be formed based on the applications from educational institutions at the finals stages of SV preparation.

Note: *) conditionally included experiments which have priority since SH (Scientific Hardware) for them is included into the preliminary list of SH, approved by the RAS Space Board on 03.12.2014

Experiments with animals

1. SE «Study of C57BL/6 mice during flight of the BION-M No. 2 space vehicle”, Code «**MLZh-02**».

Principle Investigator: Doctor of Biological Sciences, Prof. **Olga Vinogradova.**
Leading institution: Institute of Biomedical Problems of RAS

Aim: Comprehensive study of combined biological effects of increased space radiation levels and weightlessness on the organism and its separate functional systems at the cellular and molecular levels.

2. SE «Study of C57BL/6 mice during flight of the BION-M No. 2 space vehicle”, Code «**MLZh-02-02**».

Principle Investigator: Doctor of Biological Sciences, Prof. **Olga Vinogradova.**
Leading institution: Institute of Biomedical Problems of RAS

Aim: Comprehensive study of combined biological effects of increased space radiation levels and weightlessness on the organism and its separate functional systems at cell and molecular levels at changed conditions of animals management with regard to the tasks to be solved during BION-M No. 3 project.

C57Bl/6 mice (n=75)
Males Females

Food type

- Paste 68% water (n=60)
- Dry + water (n=15)

Hardware

- **Bios-02 Significantly Modified Bios-01**
- **Bios-02-02 Re-designed habitats suitable for centrifugation**

Areas of research:

- **CNS & sensory system**
- **Muscles**
- **Bones**
- **Fluid-electrolyte metabolism & excretion**
- **Cardiovascular system**
- **Gender differences**

PREPARATION	FLIGHT/ EXPOSURE	POSTFLIGHT INVESTIGATIONS
FLIGHT EXPERIMENT		
Group formation Surgeries Tests Animal selection	**Orbital flight** Metabolism, BP & HR, behavior monitoring	Animal *in vivo* examinations and tissue investigations 1 hr, 12 hr, 5 & 15 days after recovery
DELAYED CONTROL EXPERIMENT		
Group formation Surgeries Tests Animal selection	**Simulated flight** Metabolism, BP & HR, behavior monitoring	Animal *in vivo* examinations and tissue investigations 1 hr, 12 hr, 5 & 15 days after recovery
VIVARIUM CONTROL		
Group formation Surgeries Tests Animal selection	**Vivarium** Metabolism, BP & HR, behavior monitoring	Animal *in vivo* examinations and tissue investigations 1 hr, 12 hr, 5 & 15 days after recovery


25/ИЮЛЬ/2017

List of foreign participants of the BION-M2 project submitted their proposals

Country	Institution	Financing institution
USA	NASA	NASA
	JSC NASA	
	ARC NASA	
	US universities (will be determined after selection process organized by NASA till 30 September 2017) Applications have been submitted by: Berkeley University (California) Washington University (Washington) California University(San Francisco) California University (San Diego) Minnesota University (Minneapolis) Stanford University (California) Florida University	

List of foreign participants of the BION-M2 project submitted their proposals

Country	Institution	Financing institution
France	CNES Cannes University Montpellier University Lille University Angers University Marcel University	CNES
Italy	Genoa University Rome University Padua University Bari University	ASI
Germany	Otto-von Guericke-University Magdeburg	DLR
Kazakhstan	Institute of Human and Animal Physiology	Ministry of Education and Science
Malaysia	Department of Technologies and Innovations of Angkasa	Agensi Angkasa Negara
China	Center of Space Life Science & Life Support Technology, School of Biological Science and Medical Engineering	Ministry of Education and Science

Experiments with animals

3. SE «Search of potential mechanosensors of *Drosophila melanogaster* cells exposed to the conditions of BION-M No. 2 space flight, code «**MSKD**».

Principle Investigator :
Doctor of Physico-mathematical Sciences **Irina Ogneva.**

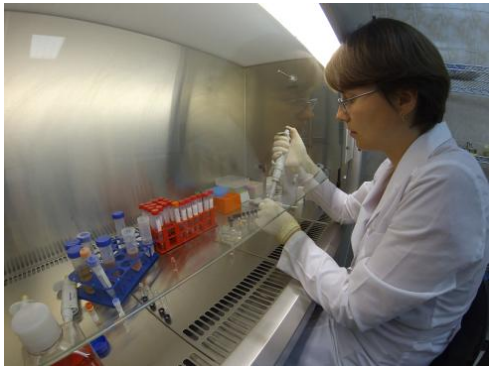
Leading Institution:
Institute of Biomedical Problems of RAS

Aim: search of candidates to the role of target proteins which are potential mechanosensors in *Drosophila melanogaster* cells exposed to the conditions of BION-M No. 2 space flight.

Experiments with animals cell cultures

1. SE «Study of SF factors effect on morpho-functional state, proliferative and developmental potential of hematopoietic stem cells», code – «MULTIINCUBATOR».
Principle Investigator : **MD, Prof. I. Davydkin**.
Leading institutions:
Samara State Medical University of Health Ministry;
FSUE “Samara Regional Center of Planned Parenthood and Reproduction”;
Samara State University
Aim: study of SF factors effects on morphological and phenotypical characteristics of hematopoietic stem cells (HSC).

2. SE «Study of SF factors effect on transcriptome of human mesenchymal stromal cells”, code «TRANSCRIPTOME MSK».
Principle Investigator : **RAS Corresponding Member L. Buravkova**.
Leading institutions:
Institute of Biomedical Problems of RAS
Samara State University
Purpose of the experiment – study of SF factors effects on transcriptional activity of human cultured mesenchymal stromal cells (MSC)



Experiments with plants, plant cell cultures, seeds, and algae

1. SE «Study of SF factors influence on higher plants which are used in medical and pharmaceutical practice" (by the example of *Calendula officinalis L.* and *Echinacea Purpurea)*, code – «**PHYTO-2**».
Principle Investigator : **Doctor of Pharmaceutical Sciences Prof. V. Kurkin.**
Leading Institution:
Samara State Medical University of Health Ministry.
Aim: assessment of the effect of combination of SF factors on anatomic-morphofunctional parameters and chemical composition of medical plants in ontogenesis (by the example of *Calendula officinalis L.* and *Echinacea Purpurea)*.

2. SE «Study of the dynamics of phototropic reactions of higher plants bines, by the example of *Physcomitrella patens (Hedw.) B.S.G.*moss, under the influence of light stimulus in different areas of light spectrum in microgravity", code - «**GRAVISENSOR-3**».
Principle Investigator : **Doctor of Technical Sciences, Prof. Yury Berkovich.**
Leading institutions:
Institute of Biomedical Problems of RAS;
Biological Department of Lomonosov Moscow State University
Aim: study of the dynamics of phototropic reactions of *Physcomitrella patens (Hedw.) B.S.G.* moss bines under the impact of light stimulus in different areas of light spectrum in microgravity.

Experiments with plants, plant cell cultures, seeds, and algae

3. SE “Study of SF factors effect on physiology, biochemistry, and genetics of plant cells and tissues of food-significant agricultural plants” , code «**GENETIKA-2**».
Principle Investigator : **Candidate of Agricultural Sciences A. Milyokhin**
Leading institute:
FSBRI – Samara Research Institute of Agriculture
Aim: study of SF factors effects on physiology, biochemistry, and genetics of plant cells and tissues of grain, grain legumes, and industrial crops for further creation of high-producing genotypes and varieties resistant to unfavourable abiotic and biotic environmental factors for their use in agro-industrial sector of Russian Federation.

4. SE «Assessment of the SF factors influence on the seeds obtained from rare plants of natural flora cultivated from the seeds exposed on board BION-M No. 1 and FOTON-M No. 4”– «**FLORA-BS2**».
Principle Investigator : **Doctor of biological sciences Prof. L. Kavelenova.**
Leading Institute:
Samara State University
Aim: assessment of the influence of different combinations of SF factors on seeds germinating ability, post-flight development of seedlings, and further ontogenesis phases of first generation of rare plants of natural flora cultivated from the seeds exposed on board BION-M No. 1 and FOTON-M No. 4, in order to reveal the effect of repeated SF factors influence in several generations.

Experiments with plants, plant cells cultures, seeds, and algae

5. SE «Study of space flight factors influence on genetic, morphobiological, and biochemical signs and characteristics of cell culture of *Rhodiola rosea* L. rootstock", code – "**RHODIOLA**".
Principle Investigator: **Candidate of Agricultural Sciences A. Milyokhin**
Leading institutions :
FSBRI – Samara Research Institute of Agriculture;
Samara State Medical University of Health Ministry
Aim: Study of the spaceflight factors impact on the pattern and dynamics of resynthesis substance accumulation by various strains of cellular biomass of roseroot (Rhodiola rosea L.) rootstock that represent interest for pharmaceutical industry, and also to receive in cells positive genetically fixed mutations and develop new effective genetically stable strains and their further use in modern pharmaceutical drugs and nutritive bioactive additives for humans and animals

6. SE "Study of peculiarities of the growth and genetic-morphological changes in algae cells in space flight", code "**VOZROZHDENIYE**".
Principle Investigator**: Doctor of Biological Sciences Prof. A. Kurakov**
Leading institute:
Biological Department of Lomonosov Moscow State University
Aim: study of peculiarities of the growth and genetic-morphological changes in algae cells in space flight conditions for the benefit of fundamental botanic, and creation of biosensors on the basis of cells for control of ecological quality of aquatic habitats, also in space greenhouses.

Experiments with microorganisms

1. SE «Study of space flight factors influence on morphobiological characteristics and properties of fungi of soil rhizosphere *Trichoderma viride* and *Trichoderma harzianum*», code– «**BIOMICROBE**».
Principle Investigator: **Candidate of Agricultural Sciences A. Milyokhin**
Leading institute:
FSBRI – Samara Research Institute of Agriculture.
Aim: study of SF factors influence on genetics, physiology, and morphology of fungi of soil rhizosphere *Trichoderma viride* and *Trichoderma harzianum* and further creation on its basis of highly productive biological products of new generation for the use in agricultural sector of Russian Federation.

2. SE «Study of space flight factors influence on life activity of microorganisms of different classes", code «**BIOCOSM**».
Principle Investigator: **Doctor of Medical Sciences Prof V. Ilyin**
Leading institutions:
Institute of Biomedical Problems of RAS;
Biological Department of Lomonosov Moscow State University
Biological Department of Lomonosov Moscow State University
State Research Institute of Genetics and Selection of Industrial Microorganisms
Aim: comprehensive study of space flight factors influence on life activity and functional characteristics of microorganisms of different classes for the benefit of fundamental science and solution of applied problems in the field of biology, biotechnology, and medicine.

Experiments with microorganisms

3. SE «Study of space flight factors influence on interaction between microorganisms and non-metallic materials», code: «**VZAIMODEYSTVIYE**».
Principle Investigator: **Doctor of Biological Sciences N. Novikova**
Leading institute:
Institute of Biomedical Problems of RAS;
Aim: comprehensive study of SF factors influence on the interaction between bacteria/fungi and polymeric substrate.

4. SE «Study of the effects of SF factors influence on bioprofiles of enterobacteria and staphylococci», code: «**ENDOFLORA-2**».0
Principle Investigator: **Doctor of Medical Sciences Prof. A. Zhestkov**
Leading institutions:
Samara State Medical University of Health Ministry
Samara State Medical University of Health Ministry
Samara State University
Aim: study of SF factors influence on bioprofiles of enterobacteria and staphylococci, typical representatives of human microbiota, also in the conditions of simultaneous cultivation.

Exobiological experiments

1. SE «Study of a possibility of bioobjects surviving in mineral section of imitator of meteorite while it is passing dense atmosphere with accompanying heating and melting», code «**METEORITE**».

Principle Investigator: **Doctor of Medical Sciences Prof V. Ilyin**
Leading institutions:
Institute of Biomedical Problems of RAS;

Biological Department of Lomonosov Moscow State University.

Purpose of the experiment – study of a possibility of surviving of bioobjects, belonging to different taxonomic groups, in mineral section of meteorite while it is passing dense atmosphere with accompanying heating and melting.

2. SE «Study of combined impacts of SF factors and minerals of exterrestrial origin on the synthesis and resistance of bioorganic molecules", code "**EXOBIOLOGIYA**"

Principle Investigator: **Doctor of Biological Sciences E. Kuzicheva**
Leading Institute:
Federal Research Center – Institute of Cytology of RAS

Purpose of the experiment – study of the effects of combined impact of SF factors and mineral bases on the process of abiogenic synthesis of bioorganic compounds - polypeptides and nucleotides.

3. SE «Reaction of permafrost microorganisms to the impact of SF factors", code "**EXOBIOFROST**".
Principle Investigator **Candidate of Biomedical Sciences E. Rivkina**
Leading institute:
FSBRI – Institute of Physicochemical and Biological Problems of Soil Science of RAS

Purpose of the experiment – Study of BION-M No. 2 SF factors impact on physiological characteristics and genetic changes in DNA structure of pure bacterial cultures and protists extracted from natural permafrost samples (multiple-aged permafrost sediments of Arctic and Antarctica)

Exobiological experiments

4. SE «Study of SF factors impact on bioprofiles of lichen and micromycete", code "**EXOMIKOLOGIYA**".
Principle Investigator: **Doctor of Biological Sciences A. Kurakov**
Leading institute:
Biological department of Lomonosov Moscow State University
Purpose of the experiment - Study of BION – M No. 2 SF factors on morphological and physiological characteristics of intact blastema, on morphological, physiological, and genetic changes in pure micromycete cultures, on composition of soil micromycete communities.

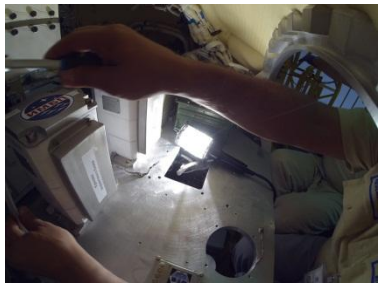
5*. SE «Study of a possibility of synthesis of prebiotic compounds from mixture "formamidemete + meteoritic material" under the open space conditions during BION-M No. 2 space flight", code "**ASTROBIO**".
PIs: RAS academician **A. Rozanov, Prof. R. Saladino, Prof. E. Di Mauro**
Leading institutions:
Laboratory of Radiation Biology in Joint Institute for Nuclear Research;
Tuscia University, Italy
Sapienza — Università di Roma, Italy
Purpose of the experiment – obtaining of new data about consequence of processes which can lead to the formation of full chemically active prebiotic system.

Biotechnological experiments

1. SE «Study of SF factors impacts on the processes of microbial utilization of organic substrates", code «**BIOUTILIZATSIYA**».
Principle Investigator: **Doctor of Medical Sciences Prof V. Ilyin**
Leading institution:
Institute of Biomedical Problems of RAS.
Purpose of the experiment – study of SF factors influence on biological activity and fermentative characteristics of cellulolitic microorganisms of different taxonomic groups with further assessment of efficiency and perspective of the use of bacteria-niodestructures for degradation of waste containing cellulose.

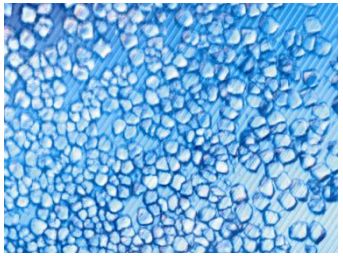
2. SE «Study of the SF factors impact on electric-chemical characteristics of microbial fuel element», code «**MTE-2**».
Principle Investigator: **Candidate of Chemical Sciences I. Smirnov**
Leading institution:
Institute of Biomedical Problems of RAS.
Purpose of the experiment – study of the effect of the factors of space flight in high orbit SV on electrical-chemical characteristics of newly developed scientific hardware – microbial fuel element with electrodes based on capillary-porous materials, and on the changes in specific and quantitative composition of microbial association





Investigations and experiments on space materials science

1. SE «Growing of protein crystals by the methods of liquid and gas diffusion on board BION-M No. 2 SV inside **BELKA-2** scientific hardware", code "**BELKA-2**".



Principle Investigator: **Doctor of Physico-mathematical Sciences A. Voloshin**
Leading institutions:
FSBRI – Institute of Crystallography of RAS
National Research Center «Kurchatov's Institute»;
FSUE Branch - Center for Operation of Ground-based Space Infrastructure – Research Institute of Launch Facility
Purposes of the experiment:

- **To study the SF conditions impact on the process of protein crystals growing by means of different methods;**
- **To grow in SF conditions the crystals of high structural perfection of practically useful protein compounds, which crystallization is not possible or hardly possible in laboratory conditions on the Earth.**

1*. SE «Growing of biocrystals with active control of crystallization process, and determination of incubation period crystal nucleation in space flight conditions on board BION-M No. 2 SV, code «**CRYSTAL-M**».
Principle Investigator: **Doctor of Technical Sciences B. Zakharov**
Leading institutions:
FSUE Special Design Bureau of the Institute of Radiotechnique and electronics of RAS
FSBRI – Institute of Crystallography of RAS
Purpose of the experiment – determination of incubation period for crystal nucleation and growing of biocrystals by the method of controlled crystallization under conditions of residual microgravity during flight tests of the BION-M No. 2 SV.

Radiobiological experiments and radiation studies

1. SE «Study of biologically significant characteristics of space ionizing radiation on board BION-M No. 2 SV", code «**BIORADIATSIYA-2**».
Principle Investigator: **Candidate of Physico-mathematical Sciences V. Shurshakov**
Leading institute:
Institute of Biomedical Problems of RAS

Purpose of the experiment – study of biologically significant characteristics of space ionizing radiation and its impacts on bioobjects in open space conditions and inside the biosatellite, and also study and processing of new methods and means of space dosimetry for their further use in future space missions.

Scientific hardware	Purpose of the experiment
1. SH «PPN- Bradoz» - assembly of passive detectors with aluminum collimators	Obtaining of integral (for the whole flight) curves of attenuation of absorbed space radiation dose over thick protections on the external surface of SV
2. SH «SPD-M» for accommodation of passive detectors of thermoluminescent and TTD types and of seeds	Obtaining of integral (for the whole flight) data about absorbed and equivalent doses of space radiation inside the SV
3. Active dosimeter«RDZ-BZM» (inside SV)	Study of the dynamics of accumulation of absorbed space radiation dose inside SV from different sources of radiation (galactic space beams, Earth radiation belts, solar proton events)
4. Active dosimeter of "RDZ-BZM" type (outside the SV)	Study of the dynamics of accumulation of absorbed space radiation dose outside the SV over protections from different radiation sources
5. Spectrometer of charged particles "Tritel-B"	Study of the dynamics of accumulation of absorbed and equivalent space radiation doses inside the SV from different sources of radiation for three protections of different thickness
6. «Bubble-detectors»	Measurement of the contribution into the dose of secondary neutrons.

Physical and technical experiments

1. SE «Control of the state and compensation of micro-accelerations on board the BION-M No. 2 SV by KSKM-2 hardware/software means", code «**KSKM-2**».
Principle Investigator : **Candidate of Technical Sciences N. Stratilatov**
Leading institution:
Space Rocket Center "Progress"
Purpose of the experiment – monitoring of the state of magnetic field inside the descent module (DM), and also of the field of onboard micro-accelerations, and study of a possibility of their increasing by means of electromagnets of KSKM-2 hardware during orbital flight of BION-M No. 2 SV, with the work of System of Moving Control without provision of controlling impacts.

2. SE «Monitoring of the state of the gas environment parameters, acceleration field, and kinematic parameters of moving inside the descent module BION-M No. 2 SV", code «**MONITOR-SA**».
Principle Investigator : **Candidate of Technical Sciences N. Stratilatov**
Leading institution:
Space Rocket Center "Progress"
Purpose of the experiment - Monitoring of the state of the gas environment parameters, acceleration field, and kinematic parameters of moving inside the descent module BION-M No. 2 SV during operations of ground preparation of the SV as a part of carrier rocket, launch of carrier rocket, and insertion of SV to the orbit, work out of deceleration pulse, descent of SV to the Earth and landing.

Physical and technical experiments

3. SE «Study of the impacts of the factors of open space on thin-film instrumental structures", code – «**CARBON-2**».
Principle Investigator: **Doctor of Technical Sciences Prof. Yu. Gorelov**
Leading institutions:
Samara State University;
FSBRI – Institute of Systems of Image Processing of RAS
Purpose of the experiment – study of the impacts of open space factors on electro-physical and optical characteristics of engineering models of thin-film instrumental structures, and also on electro-physical and optical characteristics of engineering models of diffraction structures based on quartz, chrome film, and resist.

4. SE «Multichannel recorder of temperatures in the containers with scientific hardware on the external surface of space vehicle" , code – «**MRT-2**».
Principle Investigator: **Doctor of Technical Sciences Prof. Yu. Gorelov**
Leading Institution:
Samara State University.
Purpose of the experiment – registration of temperatures of the scientific hardware elements allocated in the containers with scientific hardware under open space conditions on the external surface of space vehicle (descent module).

Physical and technical experiments

5*. SE «Study of the prototype of high-stable board source of IR light based on the phase transfer of eutectic alloy indium – bismuth in space flight conditions", code «**CALIBR-2**».
Principle Investigator: **Doctor of Technical Sciences Prof. V. Sapritskiy**.
Leading institution:
The All-Russian Research Institute for Optical and Physical Measurements Federal State Unitary Enterprise

Purpose of the experiment – Study of the phase transfer of melting-crystallization of eutectic alloy In-Bi with simultaneous testing of the prototype of on-board black body based on the phase transfer of melting In-Bi as a perspective high-stable source of IR light for on-board calibration of the hardware for Earth observation under conditions closed to weightlessness (microgravity).

Thank you for your attention!