Ground-based experiments – Via ISS – to deep space

International science project

SIRIUS

Stage four:
SIRIUS-23

Moscow, 2024

SIRIUS project management

Orlov Oleg Igorevich
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Project Executive Director and Chairman of the Organizing Committee

Esin Valery Yurievich
Deputy Head for Engineering and Technical issues

Bubeev Yuri Arkadievich
Deputy Head for Psychological Support

Poddubko Svetlana Viktorovna
Deputy Head for Sanitary and Hygienic Support

Niyazov Arslan Ramilevich
The responsible doctor of the experiment

About the SIRIUS project

Going beyond the Earth's orbit and conducting piloted exploration of nearest space objects in the Solar System (as well as building extraterrestrial orbital facilities and planetary bases) are a new stage in piloted space development. A stage that requires solving a wide range of technical, physiological and psychological problems which crews may face in-mission.

The Institute of Biomedical Problems of the Russian Academy of Sciences together with Russian space organizations and international partners conduct advanced research to find countermeasures and technologies to protect the health of cosmonauts in space missions beyond the Earth's orbit.

In order to solve the above-mentioned problems and reduce risks in interplanetary space missions, the IBMP organized a large-scale international isolation project titled SIRIUS *(Scientific International Research In Unique terrestrial Station)*. The project is a series of scientific model experiments lasting 17, 120, 240, and 366 days.

The project is conducted inside the hermetic habitat of the Ground-Based Experimental Facility (NEK) of the IBMP RAS, which is a part of the Unique Scientific Facility «The Medical and Technical Facility for Testing Innovative Technologies of Space Biomedicine and Supporting Orbital and Interplanetary Flights and Development of Practical Healthcare».

Sirius Goal and Scenario

The SIRIUS scientific program was developed on the basis of the Main Provisions of the draft Strategy of Russian Piloted Cosmonautics Until 2050 (ROSCOSMOS, 2015), and is a continuation of the research began in the MARS-500 project, and focusing on medical and psychological risks in long-duration autonomous piloted space missions and use of orbital and planetary bases.

The general scenario simulates medical and psychological effects major significant effects possible in long-duration space missions of international crews.

Those include:

1. Prolonged absence of resupply vehicles, limited resources and autonomy of stay;
2. Long-term and regular extravehicular activities accompanied by significant physical strain and night work;
3. Professional activities that require the mobilization of cognitive functions and complex motor skills after exposure to long-term space flight factors (including isolation, monotony, inactivity, etc.). Docking with transporters arriving to the station and testing remote control of robotic devices, including time-delayed operation;
4. Problems of intra-group interaction in a cross-cultural crew in the conditions of long-term stay in a limited volume (crowding, sensory deprivation, monotony, imposition of contacts, etc.);
5. Limited communication between the crew and the Mission Control Center and external communicators via audio and computer networks;
6. Gender-mixed crew;
7. Implementation of joint international experiments with close cooperation of performers.

Stages of the SIRIUS project:

Stage I (2017): 17 days (completed))
Stage II (2019): 4 months (completed)
Stage III (2021–2022): 8 months (completed)
Stage IV (2023–2024): 1 year (completed)

SIRIUS-17

Duration: 17 days

Crewmembers
first row (from left to right):
Ilya Rukavishnikov – flight physician
Mark Serov – crew commander
Viktor Fetter (Germany) – flight engineer
second row:
Nataliya Lysova – researcher
Anna Kikina – flight engineer
Elena Luchitskaya – researcher

SIRIUS-19

Duration: 4 months

Crewmembers *(from left to right):*
Anastasia Stepanova – researcher
Allen Mirkadyrov (USA) – researcher
Stephania Fedyai – flight physician
Euvgeniy Tarelkin – crew commander
Darya Zhidova – flight engineer
Reinhold Povilaitis (USA) – researcher

SIRIUS-21

Duration: 8 months

Crewmembers
first row (from left to right):
William Brown (USA) – researcher
Oleg Blinov – crew commander
Saleh Omar Al Ameri (UAE) – researcher
second row:
Victoria Kirichenko – flight physician
Ashley Kowalski (USA) – flight engineer
Ekaterina Karyakina – researcher

Medical-technical experimental facility scheme

The Ground-Based Experimental Facility of the IBMP RAS was designed for simulation of the life conditions and crew activities that are maximally close to real spaceships; as well as for support of experiments simulating space missions, including interplanetary ones, with the duration of 500 days or more and crews consisting of 4-6 people.

The facility consists of several experimental units (EU) including:

1. Module EU-50.
Module EU-50 with the total volume of 50 m^3 is meant for simulation of the landing Martian module with a capacity of four crewmembers during 2-3 months, and it includes:

- living quarter, that includes four berths and working zone;
- kitchen;
- lavatory;
- two transfer tunnels with hatches for passing into the module EU-150 and into the lock chamber of the simulator of the Martian surface;
- life support systems.

2. Module EU-100.
Module EU-100 with the total volume of 100 m^3 is meant for conduction of medical and psychological experiments, and it includes:

- living quarter, including two berths and working zone;
- kitchen – dining-room;
- lavatory;
- working places with the installed medical equipment;
- transfer tunnel with hatches connected with the module EU-150;
- hermetical door at the end of the module and emergency hatch at the opposite end of the module;
- life support systems.

3. Module EU-150
Module EU-150 with the total volume of 150 m^3 is meant for accommodation and living of six crew members, and it includes:

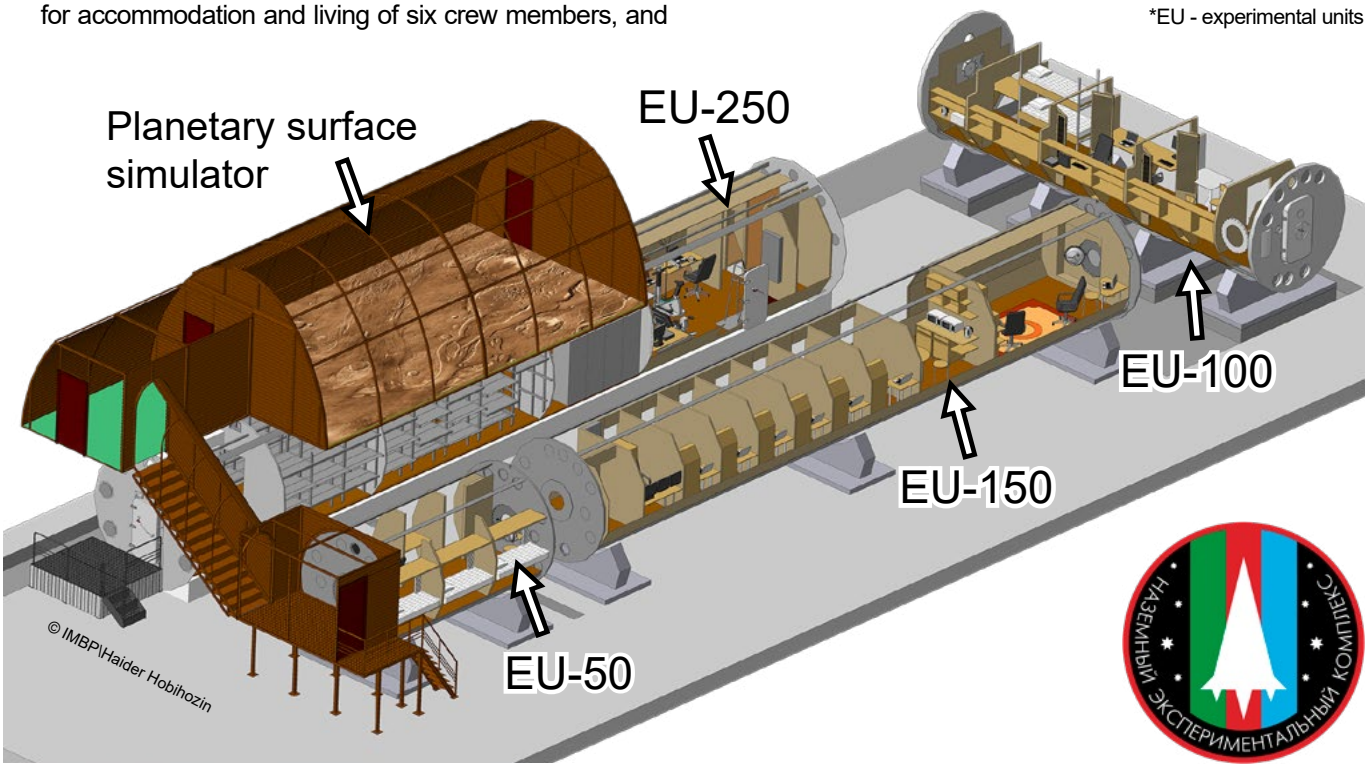
- six individual quarters;
- living-room for having rest and general gatherings;
- kitchen;
- lavatory;
- the main console;
- three transfer tunnels with hatches – end one for transfer into the module EU-50, end one for transfer into the module EU-100 and side one for transfer into the module EU-250;
- life support systems.

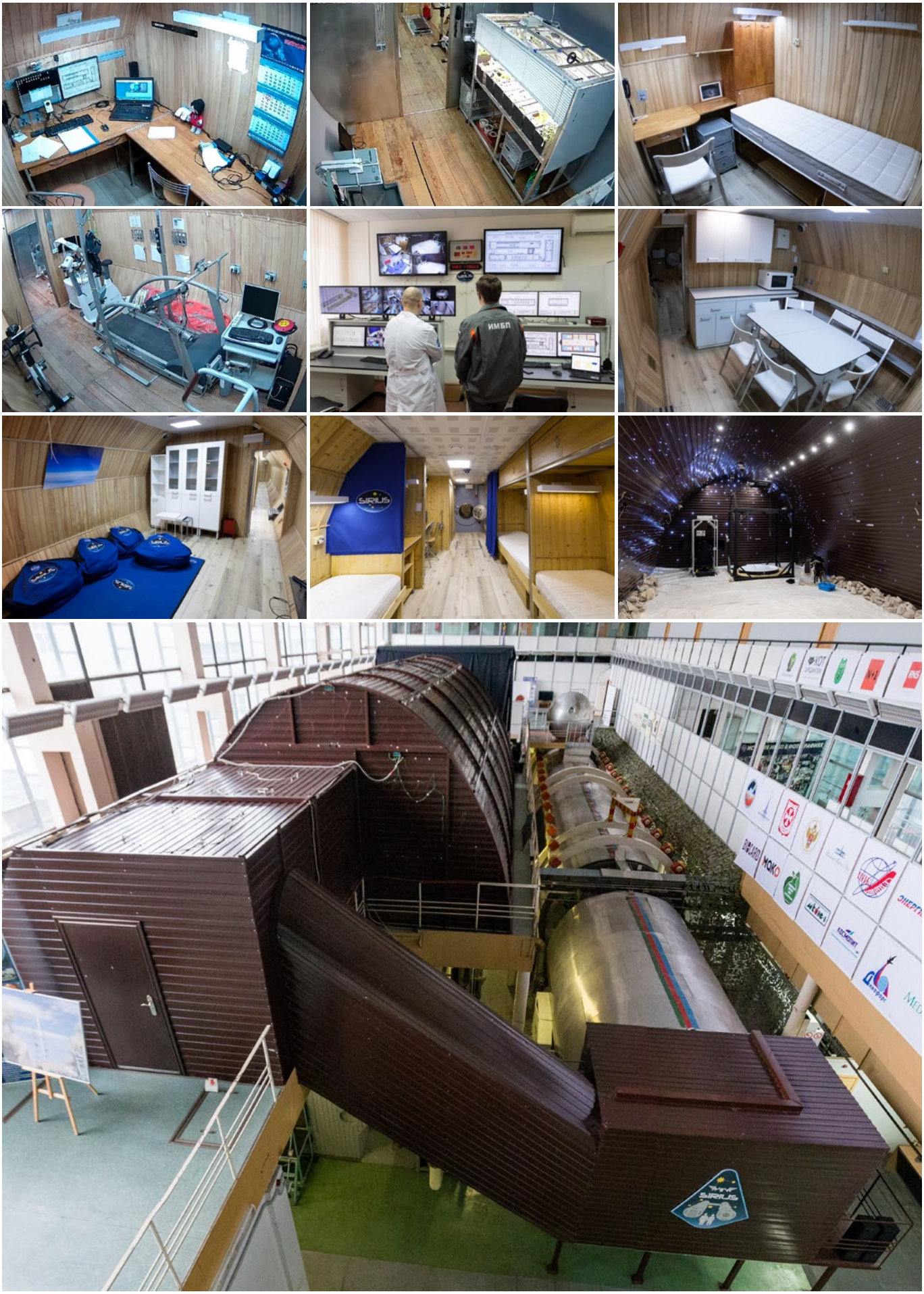
4. Module EU-250
Module EU-250 with the total volume of 250 m^3 is meant for storing of food and non-food stores (disposable plates and dishes, clothes, etc.), sports training, installation of the experimental greenhouse, it includes:

- freezer for storage of food products;
- store-place with shelves for storage of food stores that do not require special conditions of storage, and disposable plates and dishes, and clothes;
- room for experimental greenhouse;
- gym;
- lock chamber for giving away waste;
- three hermetical doors – one for connection of the module with the transfer tunnel into the module EU-150, two hermetical doors with metallic stairs at the ends of the module for pre-launch loading of food stores;
- life support systems.

5. Module "Planetary surface simulator" (PSS)
Module PSS with the total volume of 1200 m^3 is meant for simulation of planet surface, and it includes:
- simulator of planet surface that is a non-hermetical chamber meant for staying of the crew in space suits, isolating from the environment;
- non-hermetical stairs and caisson separating the SMS module from the module EU-50 and having storeroom for storage of the space suits, wardrobe and a transfer tunnel.

*EU - experimental units




ИМБП

Stage IV
SIRIUS-23 (366-day isolation)

SIRIUS-23 is a 12-month experiment which was conducted inside the Ground-Based Experimental Facility (NEK) of the IBMP RAS in Moscow. It reproduced the conditions of a mission beyond the low-Earth orbit, including scientific and operator activities and operation of complex technical systems. The international crew included four women and two men: Crew Commander, Flight Engineer, Flight Physician and three Researchers.

SIRIUS-23 Scenario

The SIRIUS-23 mission scenario is based on simulating a long-duration Lunar mission and includes testing the elements of a piloted expedition to more remote space objects.

The SIRIUS-23 scenario covered simulation of a Lunar mission, including docking with transporters, circumnavigation and finding a landing site, multiple landing of 4 crew members on the Lunar surface, as well as remote rover control.

In order to simulate surface activities, the team uses special simulators and a virtual reality system developed at the IBMP, which allows to simulate a wide range of professional conditions (including emergencies).

The scenario simulates:

- classic adverse factors common to space flight and hermetic chamber experiment: sensory deprivation, monotony, restriction of social contacts, limited living space and controlled habitat;
- factors of autonomous interplanetary space expedition, including limited resources (food, water, clothing, consumables, etc.) with 3 resupply transport ships in 12 months;
- space crew professional activities, such as docking of transport ships, landing of the lunar module, robotic equipment operation;
- communication delay of up to 5 minutes one way;
- selecting a mixed-gender multinational crew;
- performing joint multinational experiments in tight cooperation with developers and research directors;
- emergencies in accordance with the ISS experience.

SIRIUS-23 objectives

Stage IV objectives include:

1. Testing new diagnostics methods and countermeasures to specific space flight factors in order to prepare new onboard experiments and equipment.
2. Performing the IBMP RAS Fundamental Research Program which covers the following topics:
   - the role of integration and regulation of the main body systems in maintaining human homeostasis in extreme conditions;
   - investigation of integrative processes in the central nervous system, patterns of human behavior in autonomous conditions and under the influence of other extreme environmental factors;
   - the role of integration and regulation of the main body systems in maintaining human homeostasis in extreme conditions;
   - investigation of adaptation mechanisms in various living systems while modeling the main features of the exploration of near and far outer space in order to develop medical and biological support for ultra-long orbital and interplanetary space flights.
3. Modelling planetary activities with simulated lunar gravity and VR systems:
   - studying the kinematics of moving around the surface under lunar gravitation;
   - studying professional activities under lunar gravitation;
   - obtaining data on the psychophysiological penalty of surface operations under lunar gravity.
4. Evaluating the crew's need in robots and IT support while performing professional activities and complex specialized operations.
5. Evaluating the influence of a simulated resource deficit caused by transport ship delay.
6. Continuing the research of the influence of communication delay on the efficiency of crew-MCC interactions; implementation of new means of communication.
7. Investigating the interactions and role distribution in a mixed-gender interplanetary crew.
8. Developing an automatic content-analysis of crew communication in order to increase the quality of psychoneurological control.

Mission stages

1. The crew reaches the orbit in a piloted crew transfer vehicle (imitated by the EU-50 module), the travels towards the Moon, reaches its orbit within 4 days and docks to the Cis-Lunar orbital station (modules EU-150, EU-100, EU-250). In the first 10 and the last 5 days of the mission, it is possible to communicate with the MCC via phone with no delay.
2. 30 days after the launch, while the spacecraft is in the cis-lunar orbit (5-minute communication delay one way), a resupply transport ship docks to it at night time. In the next 48 hours the crew works day and night without sleeping.
3. The first surface walk is started for Mission Day 62. A pre-designated part of the crew prepares for the landing and works out the elements of landing scenario. After that, two surface walks are performed. The crew is divided into 2 teams: the landing team (4 peopple) and the orbital team (2 people). Each surface walk is performed in accordance with the scenario. Research is conducted on the joint activities and influence of psychological compatibility on its efficiency.
4. On Mission Day 90, the second resupply transport ship docks to the station similarly to point 2.
5. The second surface walk is performed on Mission Days 125-129.
6. On Mission Day 180, the arrival of the third resupply spacecraft is planned.
7. The third surface walk is planned on Mission Days 188-192.
8. The fourth surface walk is planned on Mission Days 251-255.
9. On Mission Day 270, the fourth resupply spacecraft is planned.
10. The fifth surface walk is planned on Mission Days 314-318.
11. Return to the Earth, starting from Mission Day 362.
12. Emergencies are simulated within Mission Days 38-332.

Crew Health and Safety

1. During the experiment, the medical care is comprised of self- and mutual assistance provided by the crew members who do not have special medical education, but who have undergone special medical training and who use standard (on-board) tools of providing medical care. The volume of assistance can be expanded through advice from ground-based medical control services.
2. The crew should have at least one professional doctor. The Responsible Doctor on the ground interacts with the Flight Physician and gives private consultations with the crew members.
3. The shift doctor of the Mission Control team conducts daily and in-depth monthly medical control over the health status of all crewmembers. If necessary, and integrated evaluation of a crewmember's health status can be performed.
4. The Mission Control specialists monitor daily activity, regular physical exercise and all sanitary and hygiene procedures, supervise the climatic and microbiological conditions inside the modules, as well control cleaning.
5. The experiment implements standard and perspective countermeasures to the factors of confined habitat.
6. The Mission Control teams are highly-qualified professionals; the crew and ground personnel undergo special training for first medical aid, emergencies and egress.

SIRIUS-23 Crewmembers

Yuri Chebotarev – Crew Commander

Russia
Position: Senior Researcher at the Yu.A. Gagarin Cosmonaut Training Center.
Education: Moscow University of Finance and Law (MFUA, Russia) – Banking and Finance; Novosibirsk State Technical University (NETI, Novosibirsk, Russia) – Automation of Mechanical Engineering.
Took part in the implementation and support of the Space Robotics experiment (GCTC) during SIRIUS-21.

Anzhelika Parfenova – Flight Engineer

Russia
Position: Co-Pilot on L-410 aircraft at Khabarovskie Avialinii (Khabarovsk Airlines, a Russian state-owned civil airline).
Education: Moscow Aviation Institute (MAI, Russia) – Aircraft Testing Specialist Program; Sasovo Flight School of Civil Aviation (SLU GA, Sasovo, Russia) – Pilot.
Test-subject in 5-day dry immersion experiments.

Ksenia Orlova – Flight Physician

Russia, resident of the Asgardia Space Nation

Position: IBMP RAS, Junior Researcher at the Laboratory of Immune System Physiology; Aerospace Physician.
Education: Russian University of Medicine (ROSUNIMED, Moscow, Russia) – General Practitioner; Federal Scientific and Clinical Center of the Russian Federal Medical-Biological Agency (FNKTs FMBA, Moscow, Russia) - Allergiology and Immunology; Russian Medical Academy of Continuous Professional Education (RMANPO, Moscow, Russia) – Aerospace Medicine.
Participated as Duty Physician in experiments with antiorthostatic hypokinesia, 7-day dry immersion, 5-day women dry immersion, and SIRIUS-21.

Olga Mastitskaya – Researcher

Belarus

Position: Junior Researcher at the Institute of Physical Organic Chemistry of the National Academy of Sciences of Belarus (IFOKh NANB, Minsk, Belarus).
Education: Belarusian State Technological University (BGTU, Minsk, Belarus) – Chemical Engineering of Organic Substances, Materials and Products.
Was one of the six ROSCOSMOS Cosmonaut Candidates selected by the National Academy of Sciences of Belarus.

Ksenia Shishenina – Researcher

Russia

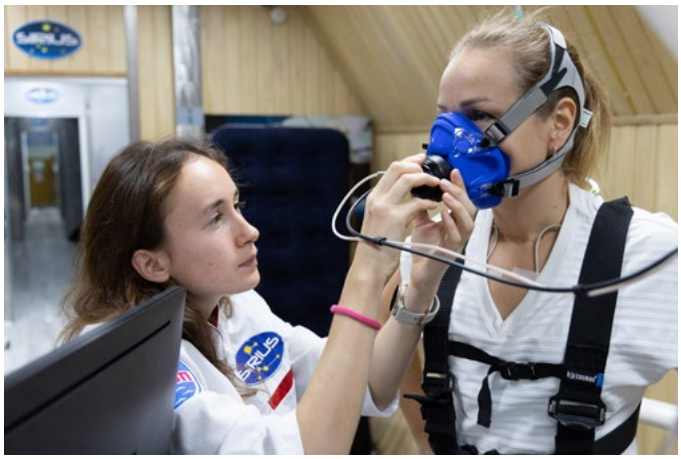
Position: Civil Flight Attendant at PAO Aeroflot (Russian civil aviation flag carrier).
Education: Saint Petersburg State University of Engineering and Economics (ENGECON – Saint-Petersburg, Russia) - Economics and Company Management; St. Petersburg State Institute of Psychology and Social Work (SPbGIPSR - Saint-Petersburg, Russia) – Psychology; M.V. Lomonosov Moscow State University (MSU, Russia) – Space Psychology; G.V. Plekhanov Russian Economic University –Journalism.
Test-subject in experiments with 5-day dry immersion.

Zaripov Rustam – Researcher

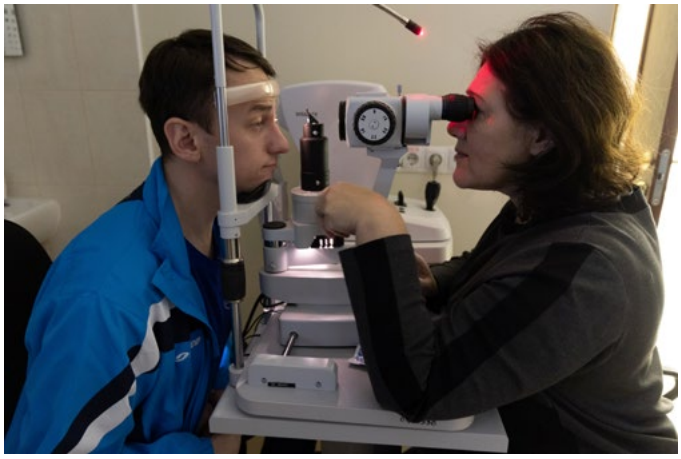
Russia

Position: IBMP RAS, Researcher at the Laboratory of Cardiorespiratory Regulation.
Education: I.M. Sechenov First Moscow State Medical University – Medical and Preventive Care; finished the Aerospace Medicine Postgraduate Program at IBMP RAS.
Took part in experiments with antiorthostatic hypokinesia, dry immersion, and SIRIUS experiments as Duty Physician. Responsible Investigator in several SIRIUS experiments.

Preparation, training and baseline data collection of crew candidates

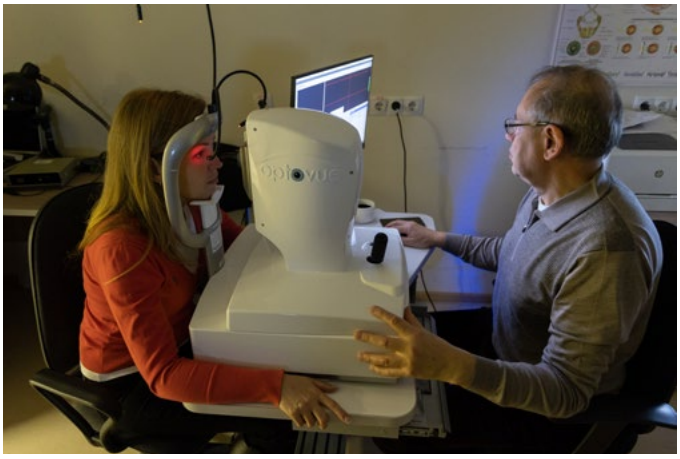







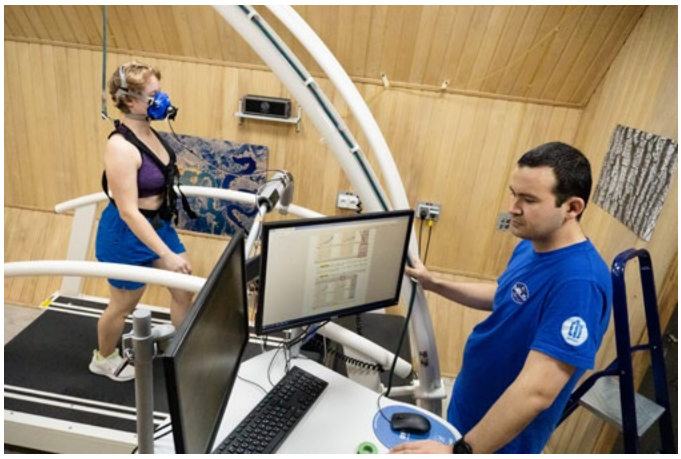

ИМБП


ЭУ 250
SIRIUS
НАЗЕМНЫЙ ЭКСПЕРИМЕНТАЛЬНЫЙ КОМПЛЕКС



Start of the 366-day mission on November 14, 2023. Press-conference and launch

Research activities during the mission



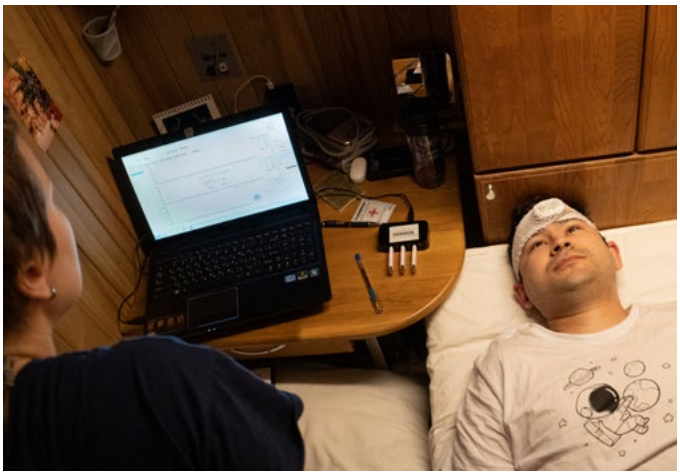


Research activities during the mission





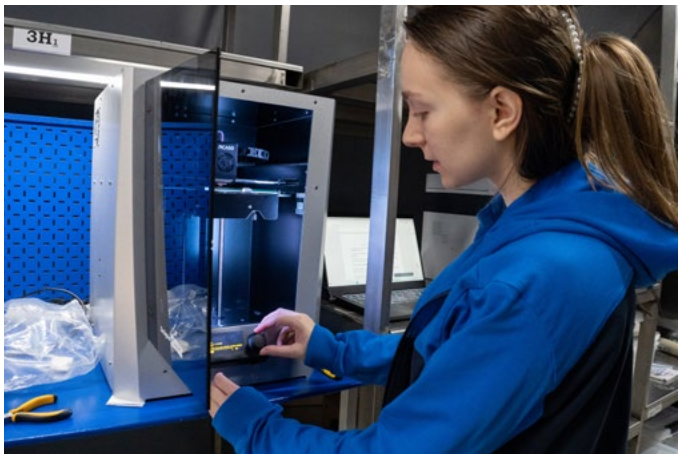


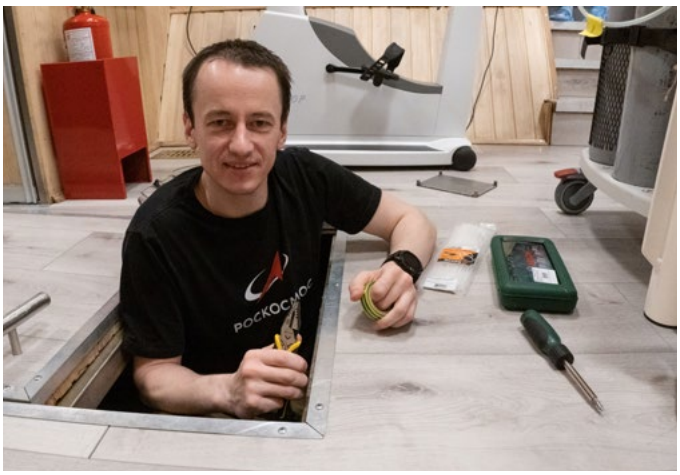



Research activities during the mission

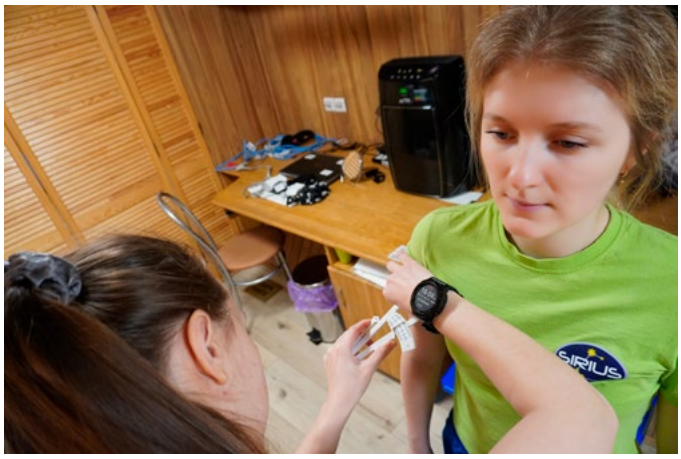




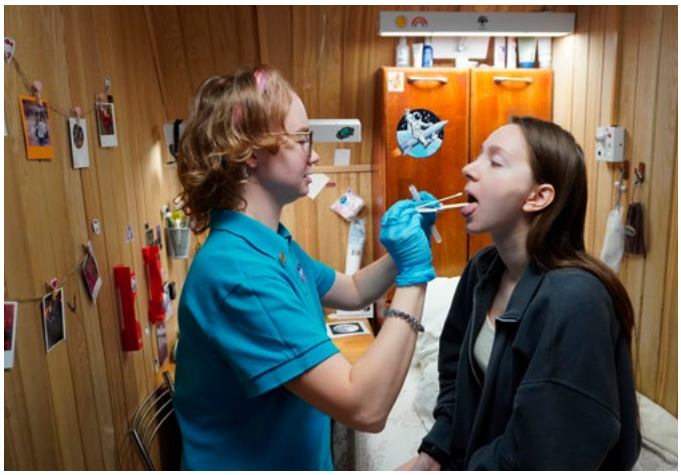


Research activities during the mission







Taking a meal

Virtual reality in SIRIUS-23

SIRIUS-23 experiment implements virtual reality systems for psychological support, as well as for simulation of spaceflight-related activities.

For psychological support, we use a set of a VR helmet and two software systems. The first one is an interactive personalized environment that simulates a living area with adjustable features, such as the interior, lighting, view from the window, music playing etc., including watching movies and 3D painting. The second system shows relaxing 360º videos accompanied by an audio records with psychological suggestions performed by a mental health specialist. The immersion effect of the virtual reality is thus strengthened the audiovisual content.

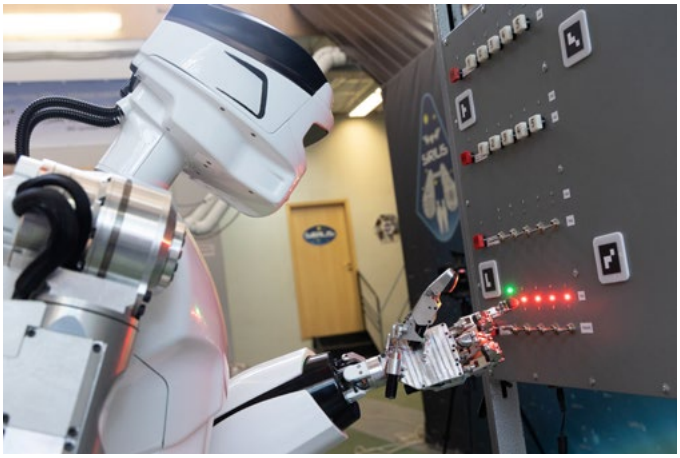
Another way to use VR systems is to simulate extravehicular activities on the Lunar surface. To do this, we use wireless VR helmets and sensors for tracking the crewmembers' locomotions, as well as systems for adaptive suspension of the operator's body or arms, which simulate the impact of altered gravitation on movements operator performance. Apart from that, the sensors allow for constant registration of physiological functions throughout the whole period of activity.

Also, the crew uses VR to remotely operate a real robot which is located outside the chambers. The robot is controlled through VR and an exoskeleton-type control-point setting device, and can move around the site and manipulate various objects. Thus, we have tested some future space flight operations, where it is assumed that robotics will be used to work in dangerous conditions for cosmonauts. The crew members showed great interest in this task.

Performing VR-simulated professional activities is in itself a means of psychological support in long-term isolation, as is the created image of space flight. In this case, we can see the effects of 'going out' beyond the confined space into a more 'spacious' and sensory-enriched environment, and having additional semantic saturation to the life in a hermetic object.

Remote-controlled robot

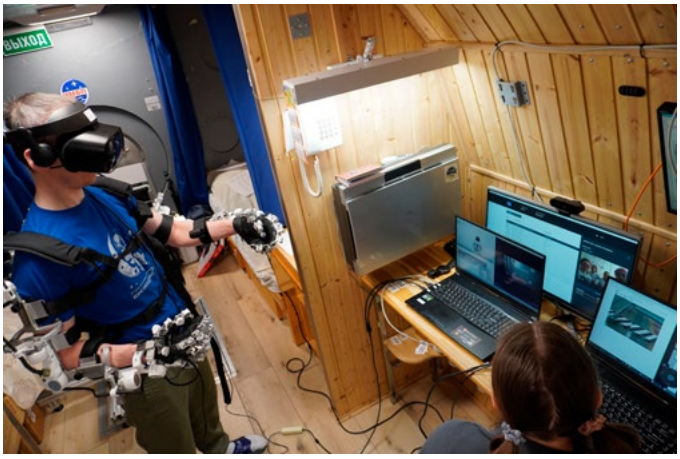


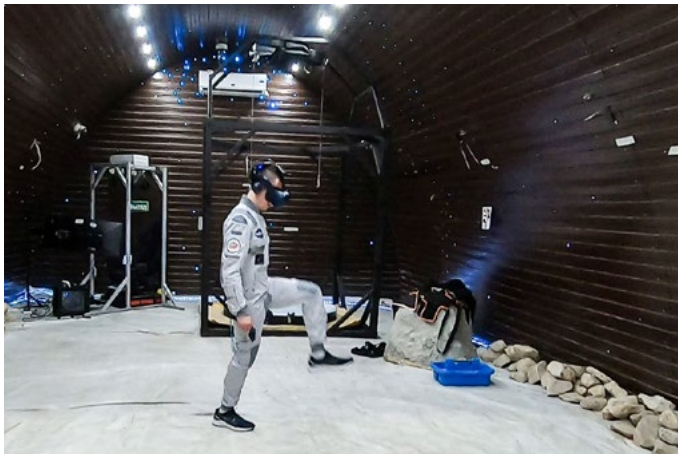



Virtual Moon

VR-psychological support system

«Descent on the Moon» during the SIRIUS-23 experiment





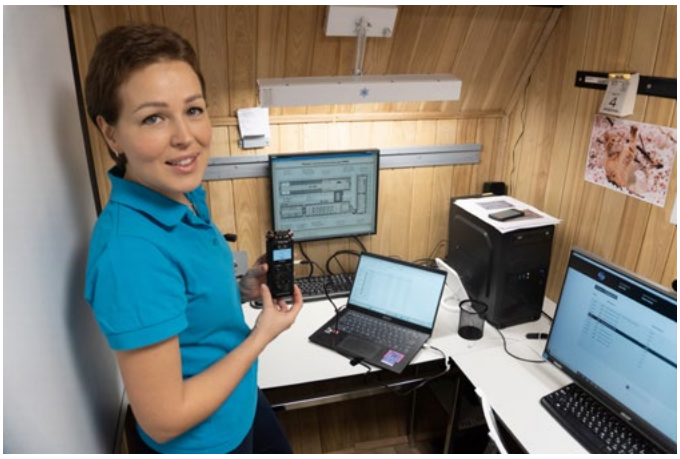
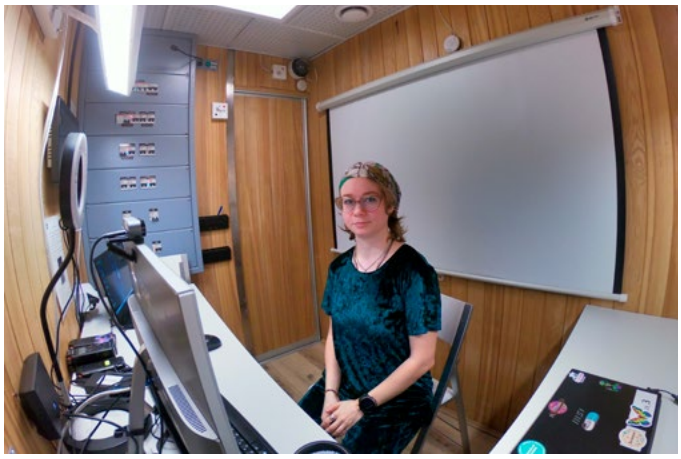
Greenhouse








External and internal mission control centers. Observations and interactions with crew members



Recreation





SIRIUS-23 scientific program

1. Psychological and psychophysiological investigations

1.1. Investigation of speech and non-verbal components of crew communication with the MCC in order to assess the psychophysiological state of crew members and the effectiveness of intergroup interaction

Responsible organization: IBMP RAS.
Scientific Leader: D.M. Shved, PhD (Candidate of Medical Science), Senior Researcher.
Principal Investigators: S.A. Lebedeva, Junior Researcher; N.S. Supolkina, Junior Researcher.
Co-PIs: A.S. Karapetyan, Junior Researcher.

1.2. Investigating VR-simulations of EVAs on the Lunar surface with simulated Lunar gravity

Responsible organization: IBMP RAS
Scientific Leaders: D.M. Shved, PhD (Candidate of Medical Science), Senior Researcher; E.S. Tomilovskaya, PhD (Candidate of Science in Biology), Head of Department, Head of Laboratory.
Principal Investigators: E.O. Litvinov, Junior Researcher; S.A. Lebedeva, Junior Researcher.
Co-PI: R.H. Abdyukhanov, OOO Intellektualnye sistemy zdravookhraneniya (a limited liability company under the laws of Russian Federation).

1.3. Dynamics of mental capacity and psychophysiological status of a human operator in prolonged isolation

Responsible organization: IBMP RAS.
Scientific Leaders: A.O. Savinkina, PhD (Candidate of Science in Psychology), Researcher;
Principal Investigator: S.A. Lebedeva, Junior Researcher.
Co-PI: K.A. Bochaver, PhD (Candidate of Science in Psychology), NOChU VO Moskovskiy institut Psikhoanaliza (a non-governmental private institution of higher education under the laws of Russian Federation).

1.4. Psychological stability and adaptation while simulating extreme factors of a long-duration space flight in an isolated small group

ПResponsible organization: IBMP RAS.
Scientific Leader: A.G. Vinokhodova, PhD (Candidate of Science in Psychology), Leading Researcher.
Principal Investigator: P.G. Kuznetsova, Researcher.
Co-PI: S.B. Velichkovskaya, PhD (Candidate of Science in Psychology), Moscow State Linguistic University, Department of Psychology and Educational Anthropology.

1.5. Dynamics of neurophysiological makers and psychophysiological parameters in crew members

Responsible organization: IBMP RAS.
Scientific Leader: T.I. Kotrovskaya, PhD (Candidate of Science in Biology), Leading Researcher.
Principal Investigators: A.V. Ivanov, PhD (Candidate of Medical Science); D.V.Schastlivtseva, Senior Researcher.

1.6. «CleverBalls»

Responsible organization: IBMP RAS.
Scientific Leader: T.I. Kotrovskaya, PhD (Candidate of Science in Biology), Leading Researcher.
Principal Investigators: A.A. Polyanichenko, Junior Researcher; D.V. Schastlivtseva, Senior Researcher.
Co-PI: V.G. Golubev, OOO Institut psychoneticheskih issledovaniy (a limited liability company under the laws of Russian Federation)

1.7. «Participatory Action Research» (PAR)

Responsible organization: IBMP RAS.
Scientific Leader: O.O. Ryumin, PhD Candidate of Medical Science, Head of Laboratory, Senior Researcher.
Principal Investigators: A.A. Polyanichenko.
Co-PIs: N.S. Supolkina, Junior Researcher; I.M. Nikiforova, Specialist; K.M. Varlamova (FGBOU VO SPbGPMU Minzdrava Rossii, a state institution of higher education under the laws of Russian Federation).
Supervisor: Professor Yu.A. Bubeev, Doctor of Medical Science, Head of Department – Deputy Director for Science.

1.7. Interpersonal interaction, communication and group work efficiency in a simulated Lunar mission with staying in the circumlunar orbit and simulated extreme space factors

Responsible organization: IBMP RAS.
Scientific Leader: V.I. Gushchin, PhD (Doctor of Medical Science), Head of Laboratory.
Principal Investigators: A.G. Vinokhodova, PhD (Candidate of Science in Psychology), Leading Researcher.
Co-PIs: P.G. Kuznetsova, Researcher; K.N. Eskov, PhD (Doctor of Science in Biology), Senior Researcher; E.O. Litvinov, Junior Researcher; G.Yu. Vasilieva, PhD (Candidate of Medical Science), Leading Researcher, Head of Laboratory; Radvan Bahbouh, Assoc. Prof., Mgr. et Mgr., Ph, MU, PhD., IAAM (QED GROUP, Charles University, the Czech Republic); Katerina Bernardova, Ph.D. (QED GROUP, Charles University, the Czech Republic).

1.8. Investigation of new types of psychological support, including VR technologies

Responsible organization: IBMP RAS.
Scientific Leader: I.A. Rozanov, Researcher.
Co-PI: K.S. Shishenina, Junior Researcher.

1.9. Virtual reality with suggestion as a means of psychological support

Responsible organization: IBMP RAS.
Scientific Leader: G.V. Kovrov, PhD (Doctor of Medical Science), Leading Researcher.
Principal Investigator: I.A. Rozanov, Researcher.
Co-PI: K.S. Shishenina, Junior Researcher.

1.10. Psychological interview

Responsible organization: IBMP RAS.
Scientific Leader/ Principal Investigator: S.O. Fedyai, PhD (Candidate of Medical Science), Researcher.

1.11. A longitudinal investigation of operator functional status in prolonged isolation using vibro-imaging technology

Responsible organization: IBMP RAS.
Scientific Leader: O.M. Manko, PhD (Doctor of Medical Science), Leading Researcher.
Principal Investigator: A.A. Bogdalova, Junior Researcher.

1.12. Evaluation and prognostication of success for operator tasks performed under monotony and reduced physical activity

Responsible organization: IBMP RAS.
Scientific Leader: E.V. Fomina, PhD (Doctor of Science in Biology), Senior Researcher, Head of Department.
Principal Investigator: A.A. Ganicheva, Junior Researcher.
Co-PIs: prof. Birol Cotuk, MD, (Marmara Üniversitesi, Turkey); prof. O.K. Bannova, PhD, (University of Houston, Cullen College of Engineering,USA).

1.13. Psychological aspects of cultivating higher plants in prolonged isolation inside a hermetic chamber.

Responsible organization: IBMP RAS.
Scientific Leader: D.M. Shved, PhD (Candidate of Medical Science), Senior Researcher.
Principal Investigator: I.A. Rozanov, Researcher.
Co-PIs: M.A. Levinskikh, PhD (Doctor of Science in Biology), IBMP RAS Scientific Secretary.

1.14. Assessment of the emotional status of a human operator in prolonged isolation by changes of facial expressions

Responsible organization: Department of Psychology, Moscow State University, Russia.
Scientific Leader: prof. A.N. Gusev, PhD (Doctor of Sciences in Psychology).
Principal Investigator: M.S. Baev.
Co-PI: A.E. Kremlev, programmer.
Supervisor: A.O. Savinkina, PhD (Candidate of Science in Psychology), Researcher, IBMP RAS.

1.15. Efficiency of VR-programs in the system of crew psychological suppo

Responsible organization: Moscow State University of Medicine and Dentistry, Russia.
Scientific Leader/Principal Investigator: T.S. Buzina, PhD (Doctor of Science in Psychology), Head of Department.
Co-PI: O.S. Shalina, PhD (Candidate of Science in Psychology), Assistant Professor.
Supervisor: I.A. Rozanov, Researcher, IBMP RAS.

1.16. Investigation of psychoneuroendocrine correlates of stress responses in stress situations

Responsible organization: Serbsky State Scientific Center for Social and Forensic Psychiatry, Russia.
Scientific Leader: prof. V.G. Bulygina, PhD (Doctor of Science in Psychology), Head of Laboratory.
Principal Investigator: N.E. Lysenko, PhD (Candidate of Science in Psychology), Senior Researcher.
Supervisor: T.V. Zhuravleva, PhD (Candidate of Science in Psychology), Researcher, IBMP RAS.

1.17. Remote monitoring of psychoemotional status in special conditions

Responsible organization: OOO Nauchno-issledovatel'skij institut mnogoprocessornyh vychislitel'nyh i upravljajushhih sistem (OOO NII MVUS), a limited liability company under the laws of Russian Federation; FGU Federal'nyj issledovatel'skij centr Informatika i upravlenie RAN (FIC IU RAN) a federal research center under the laws of Russian Federation.
Scientific Leader: Ya.S. Korovin, PhD (Candidate of Science in Technology) Chief Designer in respective field (OOO NII MVUS).
Principal Investigator: prof. B.A. Kobrinskiy, Head of Department (FIC IU RAN).
Co-PI: prof. Yu.A. Bubeev, Doctor of Medical Science, Head of Department – Deputy Director for Science.
Supervisor: A.V. Ivanov, Leading Researcher, Head of Laboratory, IBMP RAS.

2. Physiological investigations

2.1. Investigation of bone system status in test-subjects isolated inside a hermetic chamber

Responsible organization: IBMP RAS, Russia.
Scientific Leader: G.Yu. Vasilieva, PhD (Candidate of Medical Science), Leading Researcher, Head of Laboratory.
Principal Investigator: K.V. Gordiyenko, Researcher.
Co-PIs: Yu.A. Popova, Leading Researcher; N.S. Gorbovskaya (OOO Asgard, a limited liability company under the laws of Russian Federation); I.A. Tyurin, CEO (OOO EvroTest, a limited liability company under the laws of Russian Federation); R.R. Gymadiev, Head of Clinical Diagnostics Laboratory (OOO EvroTest); Rahul Saini, Senior Technical Assistant (Post Graduate Institute of Medical Education and Research, India); Gerlinde Metz, Prof. sc. nat. (Canadian Centre for Behavioural Neuroscience, University of Lethbridge, Alberta, Canada); Tony Montina, MSc (NMR Facility, University of Lethbridge, Alberta, Canada).

2.2. Basal metabolic rate in healthy humans under 12-month isolation inside a confined habitat with simulated atmosphere

Responsible organization: IBMP RAS, Russia.
Scientific Leader: V.M. Baranov, RAS academician, PhD (Doctor of Medical Science), Chief Researcher, Head of Discipline.
Principal Investigators: A.V. Demin, Researcher; R.N. Zaripov, Researcher.
Co-PI: G.Yu. Vasilieva, PhD (Candidate of Medical Science), Leading Researcher, Head of Laboratory.

2.3. Thermoregulation in humans living in an isolated habitat

Responsible organization: Indian Institute of Space Science and Technology (IIST), Thiruvananthapuram, India.
Scientific Leader: V.M. Baranov, RAS academician, PhD (Doctor of Medical Science), Chief Researcher, Head of Discipline.
Principal Investigator: S.R. Shine, PhD, Associate Professor.
Co-PIs: prof. H.V. Easwer; prof. S Manikandan, prof. B. Jayanand Sudhir (Sree Chitra Thirunal Institute for Medical Sciences and Technology); prof. D. Mishra (IIST).
Supervisors: V.B. Rusanov, PhD (Candidate of Science in Biology), Head of Laboratory; Yu.A. Popova, PhD (Candidate of Medical Science), Leading Researcher; D.M. Shved, PhD (Candidate of Medical Science), Senior Researcher; A.O. Savinkina, PhD (Candidate of Science in Psychology), Researcher; A.R. Nyazov, Senior Researcher – Aerospace Physician.

2.4. Biomarkers of lipid peroxygenation in the exhaled air and blood of a healthy person, and the functional status of the myocardium in the period of acute adaptation to prolonged isolation inside a hermetic chamber

Responsible organization: IBMP RAS, Russia.
Scientific Leader: L.N. Mukhamedieva, PhD (Doctor of Medical Science), Leading Researcher, Head of Laboratory.
Principal Investigator: I.A. Grabeklis, Researcher.
Co-PI: prof. V.N. Ardashev, PhD (Doctor of Medical Science), FGBU DPO CGMA UDP RF – a federal institution for medical training under the laws of Russian Federation.
Supervisor: A.S. Petrov, physician (FGBU DPO CGMA UDP RF).

2.5. Assessment of respiratory function in isolation inside a hermetic chamber

Responsible organization: IBMP RAS, Russia.
Scientific Leader: A.I. Dyachenko, PhD (Doctor of Engineering Science), Head of Laboratory.
Principal Investigators: A.N. Mikhailovskaya, Junior Researcher; S.N. Astafieva, Junior Researcher.
Co-PI: A.E. Kostiv, PhD (Candidate of Engineering Science) - V.I. Il'ichev Pacific Oceanological Institute (Far Eastern Branch Russian Academy of Sciences).
Supervisor: A.N. Mikhailovskaya, Junior Researcher.

2.6. Investigation of vascular bed status in test-subjects isolated inside a hermetic chamber (12 months)

Responsible organization: IBMP RAS, Russia.
Scientific Leader: I.M. Vasiliev, PhD (Candidate of Medical Science), Researcher, surgeon.
Co-PIs: R.R. Gymadiev, Head of Clinical Diagnostics Laboratory (OOO EvroTest); K.S. Kireev, PhD (Candidate of Medical Science), Head of Department (Gagarin Cosmonaut Training Center).

2.7. Neurovegetatic regulation and microcirculatory-tissue systems functional status in 12-month isolation

Responsible organization: IBMP RAS, Russia.
Scientific Leaders: V.B. Rusanov, PhD (Candidate of Science in Biology), Head of Laboratory; Yu.A. Popova, PhD (Candidate of Medical Science), Leading Researcher; A.A. Fedorovich, PhD (Candidate of Medical Science), Senior Researcher.
Principal Investigator: D.V. Pashkova, Junior Researcher.
Co-PIs: A.V. Dunaev, PhD (Doctor of Engineering Science), Associate Professor, Leading Researcher; E.V. Zharkikh, Intern Researcher, Yu.I. Loktionova, Intern Researcher (Biomedical Photonics R&D Center, I.S. Turgenev Orel State University, Orel, Russia); V.V. Sidorov, CEO (OOO NPP LAZMA, a limited liability company under the laws of Russian Federation).

2.8. Adaptive reserves of the human autonomic nervous system in the sleep-wake cycle: individual monitoring and personalized countermeasures to their decrease in prolonged isolation

Responsible organization: IBMP RAS, Russia.
Scientific Leader: G.V. Kovrov, PhD (Doctor of Medical Science), Leading Researcher.
Principal Investigator: A.G. Chernikova, PhD (Candidate of Science in Biology), Senior Researcher.

2.9. Psychophysical profile and overall performance capacity dynamics in test-subjects of a model experiment

Responsible organization: IBMP RAS, Russia.
Scientific Leader/Principal Investigator: V.A. Orlov, PhD (Doctor of Science in Biology), Leading Researcher, Head of Laboratory.
Co-PI: O.B. Fetisov, Senior Researcher.
Supervisor: O.V. Strizhakova, Doctor of Education (Candidate of Science in Education Science).

2.10. Efficiency of various training regimes in maintaining human physical performance under hypodynamia.

Responsible organization: IBMP RAS, Russia.
Principal Investigator: E.V. Fomina, PhD (Doctor of Science in Biology), Leading Researcher, Head of Department.
Co-PIs: E.V. Lemeshko, PhD (Candidate of Medical Science), Head of Laboratory (Institute of Physiology, Belarus National Academy of Sciences, the Republic of Belarus); prof. O.K. Bannova, PhD, (University of Houston, Cullen College of Engineering,USA).

2.11. Circadian clock genes expression in test-subjects isolated inside a hermetic chamber (12 months)

Responsible organization: IBMP RAS, Russia.
Scientific Leader: G.Yu. Vasilieva, PhD (Candidate of Medical Science), Leading Researcher, Head of Laboratory.
Principal Investigator: D.P. Sidorenko, Junior Researcher.
CoPIs: I.V. Kutina, Leading Specialist; E.A. Tyurin, CEO; R.R. Gymadiev, Head of Clinical Diagnostics Laboratory (OOO EvroTest).

2.12. Functional status of the visual system of a human operator staying in a 12-month isolation with LED-lighting

Responsible organization: the Hermann von Helmholtz National Medical Research Center for Eye Disease, Moscow, Russia.
Scientific Leader: V.V. Neroev, PhD (Doctor of Medical Science), RAS Academician, Director.
Principal Investigator: prof. M.V. Zueva, PhD (Doctor of Science in Biology), Head of Department.
Co-PI: O.M. Manko, PhD (Doctor of Medical Science), Leading Researcher, Head of Laboratory (IBMP RAS).
Supervisor: A.M. Aleskerov, Researcher (IBMP RAS).

2.13. Impact of LED-lighting on the visual function of a human operator in prolonged isolation

Responsible organization: Institute for Information Transmission Problems of the Russian Academy of Sciences (Kharkevich Institute).
Scientific Leaders: G.I. Rozhkova, PhD (Doctor of Science in Biology), Chief Researcher (Kharkevich Institute); O.M. Manko, PhD (Doctor of Medical Science), Leading Researcher, Head of Laboratory (IBMP RAS).
Principal Investigators: M.A. Gracheva, PhD (Candidate of Science in Biology), Senior Researcher; A.A. Kazakova, Senior Researcher; A.V. Belokopytova, Researcher.
Supervisor: A.A. Kazakova, Senior Researcher.

2.14. Morphofunctional status of the visual system in 12-month natural light deprivation

Responsible organization: IBMP RAS, Russia.
Scientific Leader: O.M. Manko, PhD (Doctor of Medical Science), Leading Researcher, Head of Laboratory.
Principal Investigators: A.M. Aleskerov, Junior Researcher, ophthalmologist; S.Yu. Golubev, PhD (Candidate of Medical Science), ophthalmologist; A.E. Baranenkov, Junior Researcher.
Co-PI: S.N. Danilichev, ophthalmologist (Yu.A. Gagarin Cosmonaut Training Center, Korolev, Russia).

2.15. Functional status of human organon auditus after a 12-month isolation

Responsible organization: IBMP RAS, Russia.
Scientific Leader: E.E. Sigaleva, PhD (Doctor of Medical Science), Head of Department.
Principal Investigator: O.B. Pasekova, Researcher, neurologist.

3. Immunity research

3.1. Impact of 12-month isolation in a hermetic chamber with artificial habitat on the phenotypic and functional parameters of human immune system

Responsible organization: IBMP RAS, Russia.
Scientific Leader: S.A. Ponomarev, PhD (Candidate of Medical Science), Head of Laboratory.
Principal Investigator: V.A. Shmarov, PhD (Candidate of Science in Biology), Senior Researcher.
Co-PIs: O.V. Kutko, Researcher; S.M. Shulgina, Junior Researcher.

3.2. Impact of 12-month isolation in a hermetic chamber with artificial habitat on latent sensitization to food-borne and inhalant allergens in humans

Responsible organization: IBMP RAS, Russia.
Scientific Leader: S.A. Ponomarev, PhD (Candidate of Medical Science), Head of Laboratory.
Principal Investigator: K.D. Orlova, Junior Researcher, physician.
Co-PIs: V.A. Shmarov, PhD (Candidate of Science in Biology), Senior Researcher, S.V. Poddubko, PhD (Candidate of Science in Biology), Leading Researcher, Head of Laboratory; K.A. Shef, Junior Researcher; I.V. Kutina, Researcher; O.O. Kudryashova, Specialist.

4. Metabolic investigations

4.1. Human plasma homeostasis in 12-month isolation inside a hermetic chamber simulating a lunar mission and surface activities

Responsible organization: IBMP RAS, Russia.
Scientific Leader: D.S. Kuzichkin, PhD (Candidate of Science in Biology, Leading Researcher.
Principal Investigator: A.Yu. Kochergin, Junior Researcher.
Supervisor: A.A. Markin, PhD (Candidate of Medical Science) , Leading Researcher, Head of Laboratory.

4.2. Typological features of initial psychoneuroendocrine status, neurohormonal regulation of hydro-electrolytic homeostasis and metabolism: interrelation, dynamics and influence on the strategy of human adaptation to prolonged isolation in a hermetic chamber

Responsible organization: IBMP RAS, Russia.
Scientific Leader: I.A. Nichiporuk, PhD (Candidate of Science in Biology, Leading Researcher.
Principal Investigator: S.A. Chistokhodova, Junior Researcher.
Supervisor: A.A. Markin, PhD (Candidate of Medical Science) , Leading Researcher, Head of Laboratory.

4.3. Homeostatic reactions in test-subjects staying in 12-month isolation inside a hermetic chamber with simulation of a Lunar expedition, including emergencies and surface activities

Responsible organization: IBMP RAS, Russia.
Scientific Leader: A.A. Markin, PhD (Candidate of Medical Science), Leading Researcher, Head of Laboratory.
Principal Investigator: O.A. Zhuravleva, PhD (Candidate of Medical Science), Leading Researcher.

4.4. Psychological and homeostatic aspects of human adaptation to 365-day isolation in a hermetic chamber

Responsible organization: IBMP RAS, Russia.
Scientific Leader/Principal Investigator: T.V. Zhuravleva, PhD (Candidate of Science in Psychology), Researcher.
Co-PIs: O.A. Zhuravleva, Leading Researcher; S.A. Chistokhodova, Junior Researcher; A.V. Serova, student (N.I. Pirogov Russian National Research Medical University).
Supervisor: A.A. Markin, PhD (Candidate of Medical Science) , Leading Researcher, Head of Laboratory.

4.5. Proteomic analysis of dry blood spots samples and physiological strategies to overcome emergencies against the background of adaptation to prolonged isolation

Responsible organization: IBMP RAS, Russia.
Scientific Leader: I.M. Larina, PhD (Doctor of Medical Science), Head of Laboratory.
Principal Investigator: I.N. Goncharov, Junior Researcher.

5. Microbiological research, sanitation and hygiene

5.1. Development of a method to ensure infection prevention and control, including crew biowaste decontamination with critical/subcritical carbon dioxide

Responsible organization: Moscow State University of Medicine and Dentistry, Russia.
Scientific Leader: prof. V.N. Tsarev, PhD (Doctor of Medical Science).
Principal Investigator: prof. E.V. Ippolitov, PhD (Doctor of Medical Science).

Supervisor: V.K. Ilyin, RAS Corresponding Member, PhD (Doctor of Medical Science), Head of Department (IBMP RAS).

5.2. Efficiency of bacteriophage-based and lactoferrin-based medicinal products in control and correction of microbiocenosis in the oral cavity and oropharynx.

Responsible organization: IBMP RAS, Russia.
Scientific Leader: V.K. Ilyin, RAS Corresponding Member, PhD (Doctor of Medical Science), Head of Department.
Principal Investigator: Z.O. Solovieva, PhD (Candidate of Science in Biology), Senior Researcher.
Co-PIs: A.Yu. Zurabov, CEO (OOO NPTs MicroMir, a limited liability company under the laws of Russian Federation); P.G. Georgiev, RAS Academician, Director (Institute of Gene Biology, the Russian Academy of Sciences, Russia).

5.3. Inclusion of an enriched food product in the ration of the test-subjects: assessment of adaptive potential

Responsible organization: IBMP RAS, Russia.
Scientific Leader: E.A. Burlyaeva, PhD (Candidate of Medical Science), Leading Researcher.
Principal Investigator: M.A. Teterina, Senior Lab Assistant.

5.4. Interrelation of microbiota along the gut-vaginal axis in women in simulated space missions.

Responsible organization: Universiti Sains Malaysia, Malaysia.
Scientific Leader/Principal Investigator: Liong Min Tze, Ph.D.
Co-PI: Probionic Corporation (South Korea), Park Yong Ha, Ph.D.

5.5. Antimicrobial coatings

Responsible organization: Institute of Strength Physics and Materials Science, The Russian Academy of Sciences, Siberian Division, Russia.
Scientific Leaders: M.I. Lerner, PhD (Doctor of Engineering Science); prof. S.D. Arutyunov, PhD (Doctor of Medical Science).
Principal Investigator: O.V. Bakina, PhD (Doctor of Engineering Science).
Co-PI: Moscow State University of Medicine and Dentistry, Russia.
Supervisor: V.K. Ilyin, RAS Corresponding Member, PhD (Doctor of Medical Science), Head of Department)

5.6. Microflora specifics and countermeasures in operators in an experiment with prolonged isolation

Responsible organization: IBMP RAS, Russia.
Scientific Leader: V.K. Ilyin, RAS Corresponding Member, PhD (Doctor of Medical Science), Head of Department.
Principal Investigator: D.V. Komissarova, PhD (Candidate of Science in Biology), Senior Researcher.
Co-PI: T.V. Priputnevich, RAS Corresponding Memer, PhD (Doctor of Medical Science), Director (V.I. Kulakov National Medical Research Center for Obstetrics, Gynecology and Perinatal Medicine).

5.7. Influence of artificial nasal mucosa on the microflora of oral cavity and oropharynx

Responsible organization: IBMP RAS, Russia.
Scientific Leader: V.K. Ilyin, RAS Corresponding Member, PhD (Doctor of Medical Science), Head of Department.
Principal Investigators: N.V. Kiryukhina, PhD (Candidate of Medical Science), Researcher; Yu.A. Morozova, Researcher.
Supervisor: V.K. Ilyin, RAS Corresponding Member, PhD (Doctor of Medical Science), Head of Department.

5.8. RemarsGel dual-component toothpaste: re-mineralizing and cleansing effects on hard tooth tissues

Responsible organization: OOO Dental Space Clinic, a limited liability company under the laws of Russian Federation.
Scientific Leader: S.A. Kholodov, CEO.
Principal Investigator: V.Yu. Kapitonov, PhD (Candidate of Medical Science).
Supervisor: N.A. Usanova, Senior Researcher (IBMP RAS).

5.9. Practical assessment of the new modernized kit «Hydrotherapeutical Procedures – M»

Responsible organization: IBMP RAS, Russia.
Scientific Leader: S.V. Poddubko, PhD (Candidate of Science in Biology), Leading Researcher, Head of Laboratory.
Principal Investigator: A.A. Domnicheva

5.10. Aerosol concentration dynamics in the atmosphere of hermetic habitats in prolonged isolation

Responsible organization: National Research Center – Kurchatov Institute, Russia.
Scientific Leader: P.A. Aleksandrov, PhD (Candidate of Science in Physics and Mathematics), Director of Kurchatov Institute.
Principal Investigator: V.I. Kalechits, PhD (Candidate of Science in Physics and Mathematics), Head of Laboratory.
Co-PI: A.V. Aleksandrova, PhD (Doctor of Science in Biology), Leading Researcher (Faculty of Biology, M.V. Lomonosov Moscow State University, Russia).
Supervisor: V.K. Ilyin, RAS Corresponding Member, PhD (Doctor of Medical Science), Head of Department

5.11. Clothes, bed cloths and garments in piloted space flight conditions: monitoring of consumption, change and sanitization procedures

Responsible organization: IBMP RAS, Russia.
Scientific Leader/Principal Investigator: I.V. Shumilina, PhD (PhD (Candidate of Science in Engineering Science), Head of Department.

6. Medical research

6.1. Medical support for women in autonomous isolated small groups

Responsible organization: IBMP RAS, Russia.
Scientific Leader: A.V. Polyakov, PhD (Candidate of Medical Science), Head of Department.
Principal Investigators: A.R. Nyazov, Senior Researcher – Aerospace Physician; S.O. Fedyai, PhD (Candidate of Medical Science), Researcher.
Co-PI: N.S. Gorbovskaya (OOO Asgard, a limited liability company under the laws of Russian Federation).

6.2. Algorithms to forecast health status dynamics in test-subjects (continued research)

Responsible organization: IBMP RAS, Russia.
Scientific Leader: O.V. Perevedentsev, PhD (Candidate of Science in Biology), Leading Researcher, Head of Laboratory.
Principal Investigator: R.V. Chernogorov, Researcher, physician.

7. Operational and technological experiments

7.1. Operational and technological aspects of using collaborative robots to ensure autonomy in a crew performing joint operations with limited functional capabilities in a simulation of a long-distance space mission

Responsible organization: Yu.A. Gagarin Cosmonaut Training Center, Russia
Scientific Leader: Dr. V.A. Dikarev, PhD (Doctor of Engineering Science), Professor, Chief Researcher and Head of the RL PISPSM (the Research Laboratory for Robotic and Intelligent Systems in Piloted Space Missions of the Yu.A. Gagarin Cosmonaut Training Center).
Principal Investigator: Yu.S. Chebotarev, Senior Researcher (RL PISPSM).

7.2. Using AR technologies for remote medical examinations and repair works

Responsible organization: IBMP RAS, Russia
Scientific Leader: Dr. Yu.A. Bubeev, PhD (Doctor of Medical Science), Professor, Head of Department, Deputy Director for Science.
Principal Investigators: Dr. A.O. Savinkina, PhD (Candidate of Science in Psychology), Researcher; Dr. D.M. Shved, PhD (Candidate of Medical Science), Senior Researcher.
Co-PIs: OOO Ascon, OOO Picasso 3D, OOO IFlaxible (limited liability companies under the laws of Russian Federation).

7.3. The system of medical support for autonomous small groups in isolation

Responsible organization: IBMP RAS, Russia
Scientific Leader: A.V. Polyakov, PhD (Doctor of Medical Science), Head of the O-03 Department, Head of Laboratory.
Principal Investigator: A.R. Nyazov, Senior Researcher – Aerospace Physician.
Co-PI: S.O. Fedyai, PhD (Candidate of Medical Science), Researcher.

7.4. Interpersonal relationships control

Responsible organization: IBMP RAS, Russia.
Scientific Leader: Dr. Yu.A. Bubeev, PhD (Doctor of Medical Science), Professor, Head of Department, Deputy Director for Science.
Principal Investigator: Dr. O.R. Ryumin, PhD (Candidate of Medical Science), Senior Researcher, Head of Laboratory, Head of Department.
Research Team: A.A. Polyanichenko, Junior Researcher; I.M. Nikiforova, Department Specialist; N.S. Supolkina, Junior Researcher; Yu.S. Chebotarev (RL PISPSM).

7.5. Investigation of human factor impact on structural coordination of the components in the «cosmonaut – spacecraft – habitat» human-machine system

Responsible organization: Yu.A. Gagarin Cosmonaut Training Center, Russia.
Scientific Leader: L.M. Korolev, PhD (Doctor of Psychology), professor, Head of Laboratory (Yu.A. Gagarin Cosmonaut Training Center).
Principal Investigator: A.V. Faleev, Senior Researcher (Yu.A. Gagarin Cosmonaut Training Center).

7.6. Field-testing a digital scheduling tool in the organization and planning of scientific experiments with long-term human crew isolation inside a hermetic facility

Responsible organization: IBMP RAS, Russia.
Scientific Leader: G.Yu.Vasilyeva, PhD (Candidate of Medical Science), Leading Researcher, Head of Laboratory.
Principal Investigator: Yu.A. Popova, PhD (Candidate of Medical Science), Leading Researcher.
Co-PIs: A.G. Vinokhodova, PhD (Candidate of Psychology), Leading Researcher; R.V. Chernogorov, Researcher – Aerospace Physician.

7.7. Study of the influence of changes in the controlled parameters of the light environment on the threshold characteristics of the operator's perception of visual information during the 8-month study with isolation according to the SIRIUS project

Responsible organization: IBMP RAS, Russia.
Scientifc Leader: A.N.Agureev, PhD (Candidate of Medical Science), Senior Researcher – Head of Laboratory.
Principal Investigator: I.V. Kutina, Researcher.
Co-PI: OOO Bilait-trade (a limited liability company under the laws of Russian Federation).
Supervisor: O.O. Kudryashova, Specialist.

7.8. Assessment of the impact on various human body systems caused by prolonged stay in a closed hermetic habitat under hypomagnetic conditions

Responsible organization: IBMP RAS, Russia.
Principal Investigator: Dr. Oleg Orov, PhD (Doctor of Medical Science), RAS Academician, IBMP RAS Director.
Research Team: Dr. A.V. Polyakov, PhD (Candidate of Medical Science), Head of Department; Dr. I.M. Vasiliev, PhD (Candidate of Medical Science), Researcher; Dr. G.Yu. Vasilieva, PhD (Candidate of Medical Science), Leading Researcher – Head of Laboratory; Dr. Yu.A. Bubeev, PhD (Doctor of Medical Science), Professor, Head of Department, Deputy Director for Science; D.V. Schastlivtseva, Senior Researcher; Dr. T.I. Kotrovskaya, PhD (Candidate of Biology), Associate Professor, Leading Researcher, Dr. A.I. Dyachenko, PhD (Doctor of Engineering Science), Head of Laboratory; Dr. V.B. Rusanov, PhD (Candidate of Biology), Head of Laboratory; Dr. G.V. Kovrov, PhD (Doctor of Medical Science), Leading Researcher; Dr. Yu.A. Popova, PhD (Candidate of Medical Science), Leading Researcher; A.V. Dyomin, Researcher; R.N. Zaripov, Researcher; D.V. Pashkova, Junior Researcher; O.V. Popova, Junior Researcher; V.A. Shurshakov, PhD (Candidate of Physics and Engineering Science), Head of Department; A.L. Vasin, PhD (Candidate of Biology), Leading Researcher – Head of Laboratory; A.V. Shafirkin, PhD (Doctor of Biology), Leading Researcher.

7.9. Evaluating the Effectiveness of AI-Generated Personality Assessments for Missions in Isolated and Extreme Environments

Responsible organization: University of Stadio, Centurion Campus, South Africa
Principal Investigator: Corna Olivier, Master of Psychology.

7.10. Monitoring human functional status in the sleep-wake cycle under prolonged isolation using the Cardioson ballistograph

Responsible organization: IBMP RAS, Russia.
Scientific Leader: Dr. G.V. Kovrov, PhD (Doctor of Medical Science), Leading Researcher, Professor.
Principal Investigator: Yu.D. Yahya, Junior Researcher.

7.11. Assessment of factual nutrition of the test-subjects

Responsible organization: IBMP RAS, Russia.
PIs: Dr. E.A. Burlyaeva, PhD (Candidate of Medical Science), Leading Researcher; K.S. Nikitina, Junior Researcher.
Co-PIs: Dr. E.A. Burlyaeva, PhD (Candidate of Medical Science), head of the Healthy Foods and Sports Nutrition medical diagnostics center.

7.12. Investigating the psychological aspects of cultivating higher plants under isolation in a hermetic facility

Responsible organization: IBMP RAS, Russia.
PIs: Dr. M.A. Levinskikh, PhD (Doctor of Biology), Scientific Secretary of the IBMP, Leading Researcher; Dr. D.M. Shved, PhD (Candidate of Medical Science), Senior Researcher; I.A. Rosanov, Researcher.

7.13. Greenhouses as a potential element of biological life support systems in long-duration isolation experiments

Responsible organization: IBMP RAS, Russia.
PI: V.A. Orzhekhovskiy, Deputy Head of Department.

7.14. Investigation of the impact of limited resources (sanitary-hygienic supplies, food, clothes, water and medicines) on the behavior and performance of an autonomous crew in a simulated mission to the Moon and a stay in the cis-Lunar orbit

Responsible organization: IBMP RAS, Russia..
Scientific Leaders: Dr. S.V. Poddubko, PhD (Candidate of Biology), Leading Researcher - Head of Laboratory; E.A. Burlyaeva, PhD (Candidate of Medical Science), Leading Researcher; AR Nyazov, Senior Researcher – Aerospace Physician; V.Yu. Esin, Head of Department.
PI: A.A. Domnicheva. Technical Support: D.V. Trikolkin.
Co-PI: OOO Scanteh (a limited liability company under the laws of Russian Federation).

7.15. Practicing joint crew activities in a radiation hazard situation

Responsible organization: IBMP RAS, Russia.
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