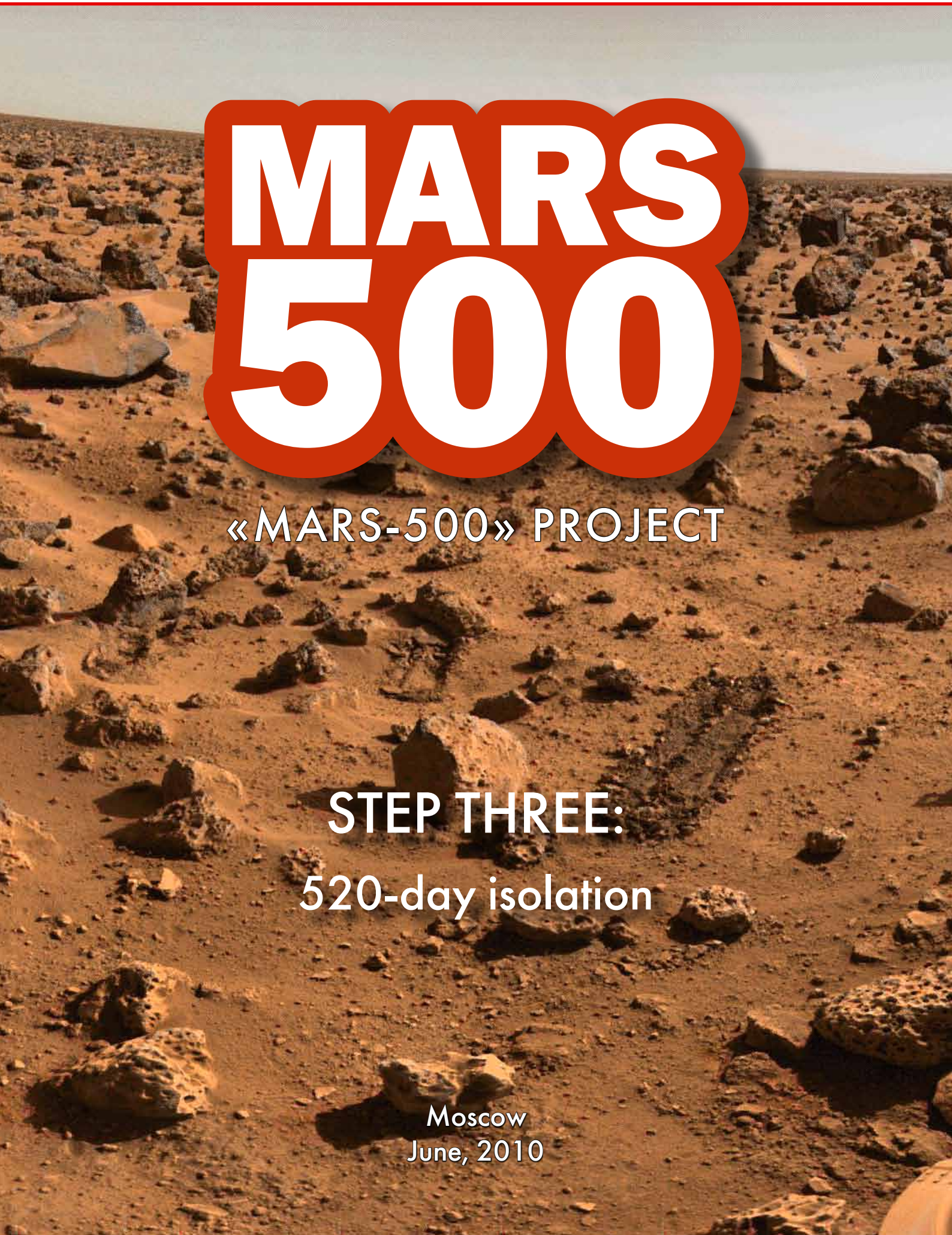
SSC RF INSTITUTE OF BIOMEDICAL PROBLEMS RAS



MARS 500

«MARS-500» PROJECT

STEP THREE:
520-day isolation

Moscow
June, 2010

Ground-based simulation investigations are very important for solving of urgent tasks of space medicine. They played an important role in substantiation of possibility of increasing of duration and reliability of space expeditions.

Simulation experiments allow to assess the concept of biomedical support of the crew of the spaceship under development or the concrete mission, assess meaning of separate factors of a space flight in changing of state of health and working capacity of the crew members, obtain necessary data for development of biomedical requirements for manned spaceships.

Mars seems to be the unique planet for investigation of issues of Solar system planets evolution, prognosis of Earth and its biosphere development. But the main thing is that Mars is the only planet that is promising from the point of view of human settlement. Perhaps, it is this that is the most important purpose of human flight to Mars in the interests of preservation of Earth civilization.

Vice-president of Russian Academy of sciences,
scientific head of SSC RF – IBMP RAS,
Academician Grigoriev A. I.

Mars attracted attention to itself as early as at Ancient times. The processes that go on on Mars are very similar to the ones that go on on Earth. That is why Mars exploration allows to determine regularities of these processes and form more adequate prognosis of their development on Earth.

Mars exploration is a difficult task, all countries possessing advanced technologies will participate in solving of this task in this or that degree. Russia has accumulated great intellectual and technological potential for organization of manned flights to Mars.

Flight to Mars is becoming more real, and orbital stations play a great role in preparation of such a flight.

Head of Federal space Agency of Russia Perminov A. N.

Russia has unique experience of conduction of human long-term space flights, support of continuous effective work on near-Earth orbit with the duration of more than a year.

During the development of the strategy and planning of a manned expedition to Mars the human factor becomes a priority, and man becomes the most valuable and vulnerable unit of the mission to a great extent determining possibility of realization of the project in whole.

In SSC RF – IBMP RAS great experience has been accumulated of conduction of long-term investigations, simulating combined influence on humans of space flight factors.

The unique experimental facility including the unique in the world set of hermetical modules with controlled habitat will allow to conduct investigation in conditions that are maximally close to the real conditions of a manned Martian expedition.

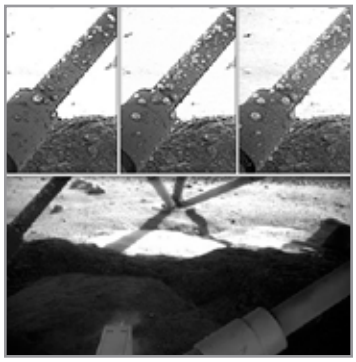
Director of SSC RF – IBMP RAS
Corresponding Member of RAS
Full Member of RAMS Ushakov I. B.

The aim of the project is obtaining of some initial data for design of space techniques and planning of the space flight to Mars. Basically it concerns two problems – people relationship during long term flight and working-off of some organization elements of such flight, taking into account that resources, necessary for vital activity of the crew and for health and activity support during the whole period of the flight, cannot be refilled outside.

An equally important issue is the psychophysiological preparation of «martian astronauts», psycho-emotional compatibility of the crew members and their motivation for task performing – it's key factors which provide the success of a real flight to Mars.

Director of «Mars-500» Project,
Deputy Director on science of SSC RF IBMP RAS,
Pilot-cosmonaut Morukov B.V..

Why Mars?

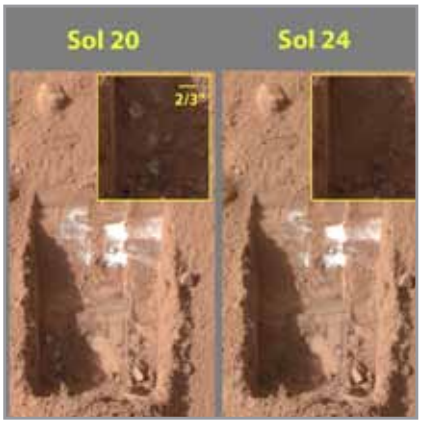


Clumps on one of Phoenix's legs were observed to grow over time.

Credit: NASA/JPL-Caltech/University of Arizona/ Max Planck Institute).

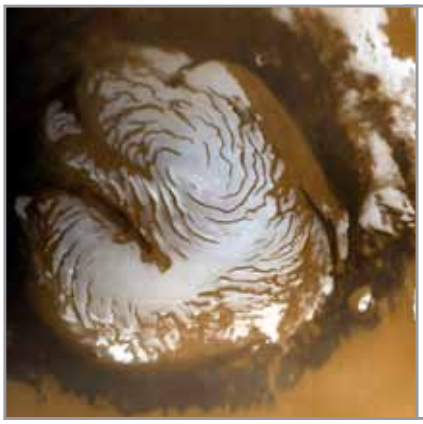
The beginning of the third millennium is marked by increasing interest of the world community to Mars, and it happens not accidentally – as compared to the majority of the rest planets of the solar system (sizzling heat on Venus, deadly cold on Titan) conditions on Mars are more suitable for its exploration. Moreover, on Earth there are sand and Arctic deserts, where environmental conditions are very similar to Martian conditions. And it means that people are able not only to land on the neighboring planet, but also to colonize it in the foreseeable future.

Another important factor increasing significantly probability of Mars exploration and colonization is confirmed (in particular by exploration probe Phoenix) existence of water, both frozen and liquid. In addition to this they managed to discover lately zones on Mars with increased content of methane, that is usually produced by living organisms. However the most important question about existence of life on the planet is still open - robots cannot give the final answer so far, only humans are able to do it, for this a manned expedition to Mars is necessary.



These color images were acquired by NASA's Phoenix Mars Lander's Surface Stereo Imager on the 21st and 25th days of the mission, or Sols 20 and 24 (June 15 and 19, 2008).

Credit: NASA/JPL-Caltech/University of Arizona/Texas A&M University



The ice on the northern polar cap of Mars

Credit: NASA/JPL/Malin Space Science Systems.

Water ice in Vastitas Borealis Crater at the north pole of Mars.

Credit: ESA/DLR/FU Berlin (G. Neukum).

The need of modeling manned flight to Mars

The problem of biomedical support of the Martian manned expedition is a new task, as it has a series of principal differences of such a mission from the orbital flight of comparable duration. And it means that the given task requires its own, new solving. The most important condition for studying and solving of this problem is organization and conduction of ground-based experimental investigations in conditions of isolation with participation of investigators-volunteers in pressurized facilities, similar to the volumes of habitable compartments of manned facilities, in conditions of artificially regulated environment, allowing to develop preliminary and approve of a set of medical, technical and organizational activities, providing creation and support of normal conditions of life and activity, preservation of physical and psychological health at all the stages of implementation of the program of the flight.

Russian specialists have undoubted priority in organization and conduction of investigations in this direction.

Distinctive peculiarities of interplanetary space flights

It is possible to single out the following principle differences of an autonomous interplanetary flight from an orbital flight that must be in this or that way realized during ground-based simulation of a manned Martian expedition:

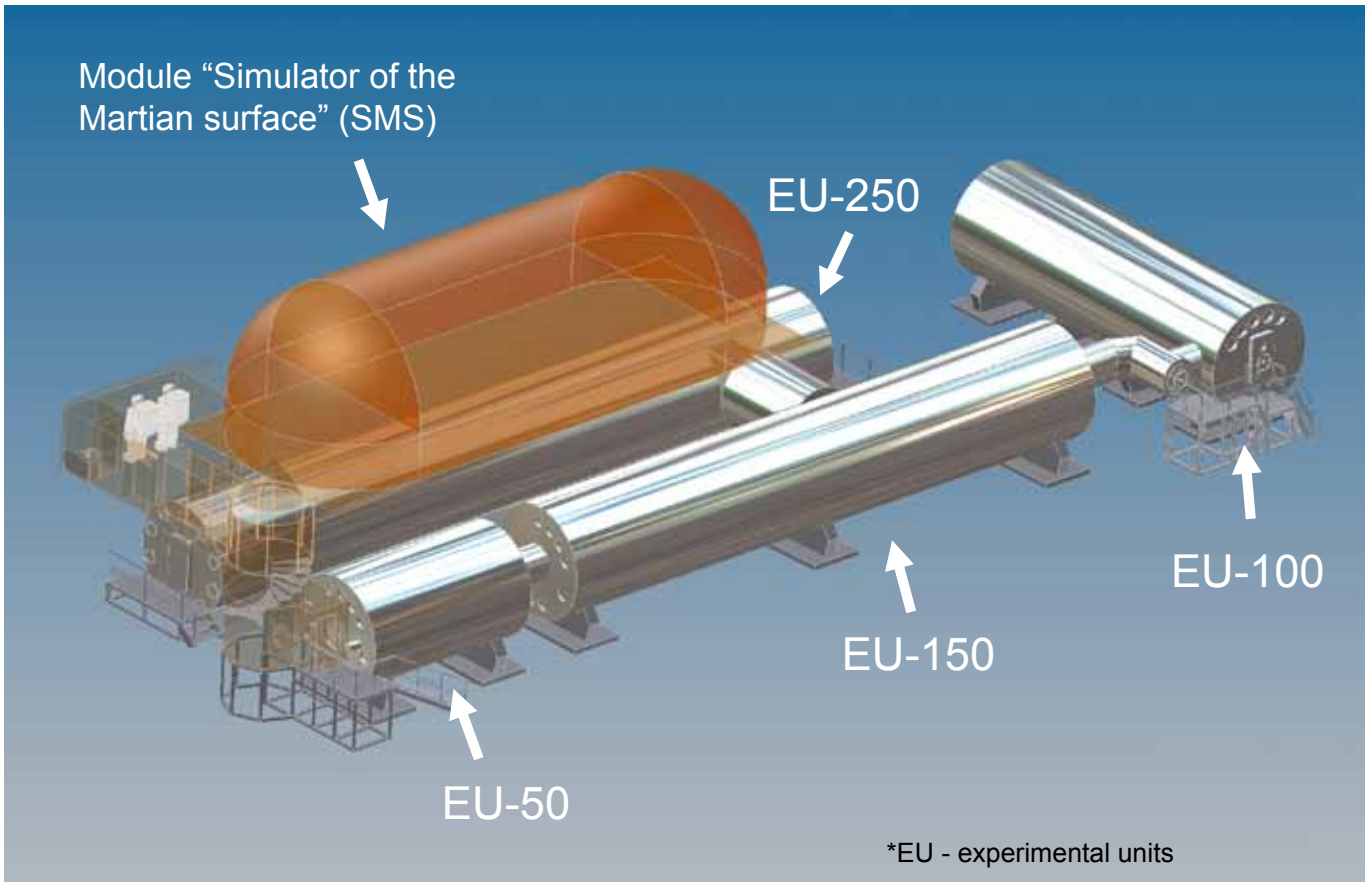
- Impossibility of additional delivery of resources (food; water; atmosphere purification means; energy; apparatus, equipment and spare parts; clothes, footwear, bed linen; medical aid means, medications; sanitary hygiene means; information sources).
- Impossibility of receiving help from Earth, including urgent return to Earth.
- Self-management of the crew in conditions of decreased operational and social control from Earth, presupposing:
    1. *self-control of the whole life activity of the crew, including control of the state of health, psychological state and working capacity;*
    2. *independent decisions taking;*
    3. *independent solving of appearing problems.*
- Limitation in operative receiving of information from Earth (signal passage delay, limitation of communication volume).
- Landing on the new planet and interaction of two groups performing different functions – the one that lands, and the one that stays on orbit.
- Specificity of off-nominal situations:
    4. *deficit or complete absence of the necessary resource;*
    5. *complete absence of communication with Earth;*
    6. *complete or partial loss of working capacity of separate crew members in connection with illness, injury, conflict;*
    7. *disorder of interpersonal interaction due to unsolvable conflict.*

Isolation experiments implemented in the «Mars-500» project

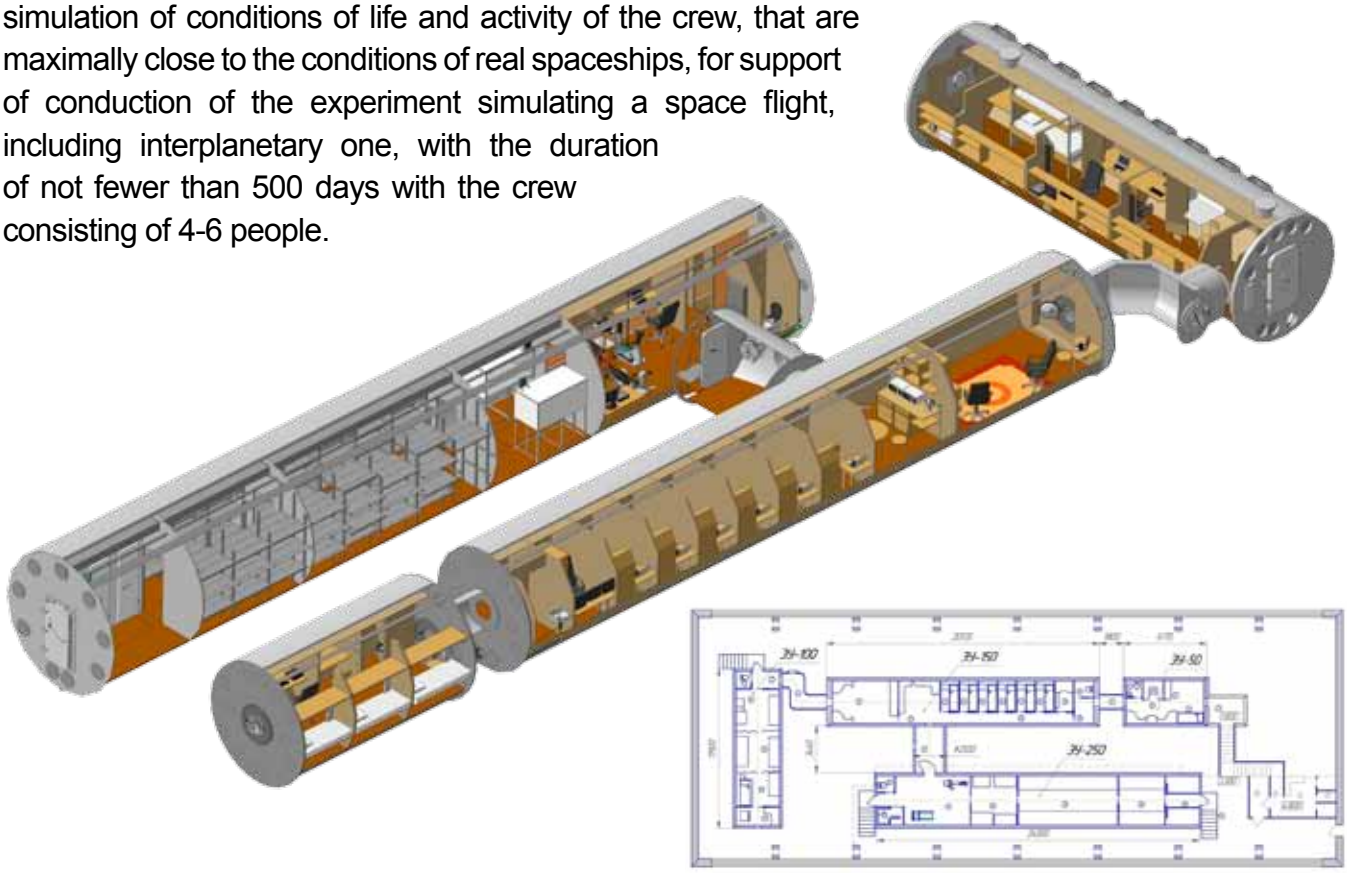
“Mars-500” project includes a series of experiments simulating these or those aspects of the given flight. The main part is a series of the experiments on long-term isolation in conditions of the specially built ground-based experimental facility. It includes:

- 14-day isolation (completed in November 2007)
- 105-day isolation (completed in July 2009)
- 520-day isolation (June 2010 – November 2011)

Medical-technical experimental facility. Main view.

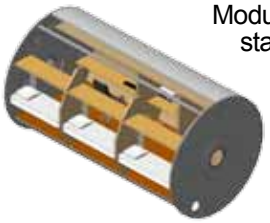


Medical-technical facility of SSC RF – IBMP RAS is meant for simulation of conditions of life and activity of the crew, that are maximally close to the conditions of real spaceships, for support of conduction of the experiment simulating a space flight, including interplanetary one, with the duration of not fewer than 500 days with the crew consisting of 4-6 people.



Medical-technical experimental facility scheme

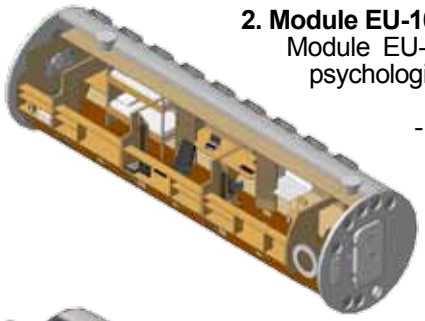
The facility consists of several experimental units (EU) including:



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 staying in it of 3 crew members during 2-3 months, and it includes:

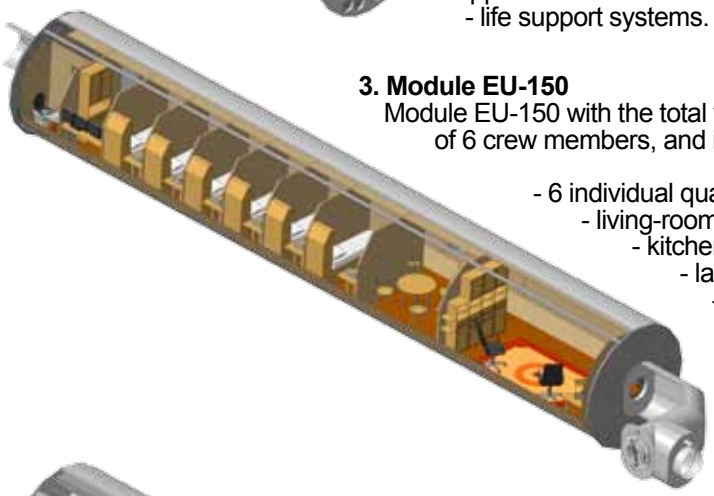
- living quarter, that includes 3 berths and working zone;
- kitchen;
- lavatory;
- two transfer tunnels with hatches for passing into the module EU-150 and into the lock chamber of the simulator of the Martian surface;
- life support systems.



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:

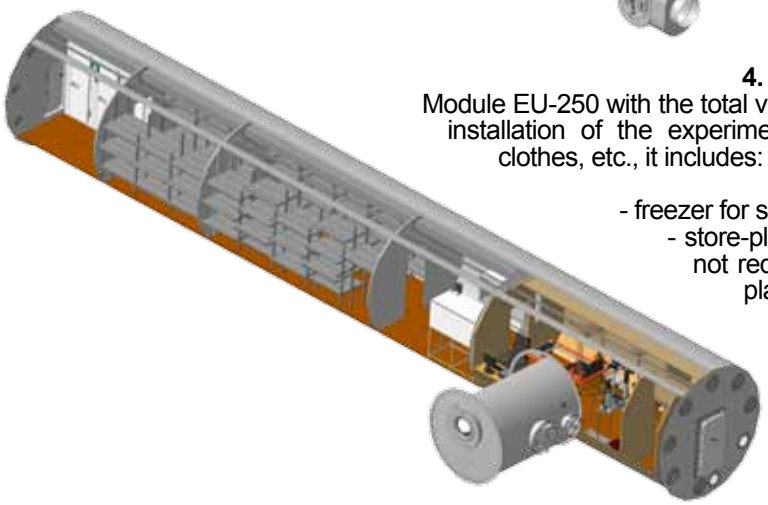
- living quarter, including 2 berths and working zone;
- kitchen – dining-room;
- lavatory;
- working places with the installed medical equipment;
- transfer tunnel with hatches connected with the module EU-150;
- hermetical door at the end of the module and emergency hatch at the opposite end of the 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 6 crew members, and it includes:

- 6 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 stores, installation of the experimental greenhouse, disposable plates and dishes, clothes, etc., 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 "Simulator of the Martian surface" (SMS)

Module SMS with the total volume of 1200 m^3 is meant for simulation of the Martian surface, and it includes:

- simulator of the Martian surface that is a non-hermetical chamber meant for staying of the crew in space suits, isolating from the environment;
- 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.

Interior of the experimental facility

Living-room, view to the side of transfer to the medical module.

Internal commander console for LSS control.

Living-room, view to the kitchen side.

Kitchen

Medical module.

Individual quarter.

Gym.

Descending module.

Transfer between the habitable and storage modules.
On the right there are lock chambers.

Storage module.

The central commander quarter.

Greenhouse.

105-day isolation

The purpose of the experiment:

The purpose of the dry-run 105-day experiment, conducted in the frameworks of “Mars-500” project – obtaining and analysis of scientific-technical information for optimal organization of preparation and efficient conduction of the main experiment simulating all the stages of a manned flight to Mars.

The main tasks of the experiment:

1. Investigation of peculiarities of physiological and psychological adaptation of crew members to conditions of autonomous functioning;
2. Investigation of interaction of the crew with the personnel of the experiment controlling center at changed communication conditions;
3. Verification of medical-technical equipment and crew life support means and scientific equipment;
4. Specification of the list and content of organizational-methodological documentation.

The main results:

Investigation of the mechanisms of adaptation of living systems during simulation of the main peculiarities of a manned Martian expedition

Criteria of the medical and psychological selection of the investigators-volunteers for the main 520-day experiments were specified.

No negative influence was found out of the noise exposition in the experiment on the state of the hearing function of the investigators-volunteers.

Positive effect was shown of course intake of phytopreparation on operators’ activity, at this no negative influence was observed on cardio-vascular system, hematological indices and indices of metabolism.

A method was verified of remote diagnostics of the state of mouth cavity with the help of a special intraoral digital videocamera with further transfer of the image to “Earth” for processing and analysis of the data.

With the use of the method of assessment of the level of constant potential of brain, in all the investigators unidirectional changes were observed – decrease of the potential in the period of isolation with restoration of its level after finishing of the experiment.

Conducted for the first time automated content-analysis of the written reports of the personnel of the experiment control center allowed to single out and to describe quantitatively peculiarities and strategies of communicative behavior of humans not depending on the periods of adaptation to the stage of the experiment.

During isolation in investigators increase of activity of creatin phosphokinase, creatinine, magne-sium and ferrum in blood was observed, tendency to decrease of concentration of total protein, urea, uric oxide, cholesterol and its fractions during compensatory increase of triglycerids content, decrease of activity of total and pancreatic lipase and amylase, not significant slowing of blood coagulation on the external way.

It was shown, that staying in pressurized facility led

to hypermobilization of the functional state of the system of natural resistance of the organisms, expressed in intensification of expression of adhesive receptors, and functional activity of phagocyte cells.

No significant changes were observed in energy-forming system of erythrocytes. Compensatory increase was observed of the activity of G6PD gene and decrease of erythropoietin. Analogous results are obtained from cosmonauts in the first weeks after finishing of long-term space flights.

The analysis of psycho-physiological status, concentration of hormones in blood and anthropometrical data showed that changes of most of them were in the frameworks of physiological norm. Two groups of investigators were singled out, one of them was characterized by moderately expressed conservatism and high degree of conformity, the other one – by expressed individualism and inde-pendence of behavior. At this the members of both groups had high stress-tolerance and self-control, low situational and personal anxiety.

With the help of three-dimensional computer quantitative tomography in most investigators after the experiment deterioration was observed of the indices of microarchitecture of the radial bone, osteopenia was registered of the tibial bone at existence of reliable signs of deterioration of its quality; the value of the bone mass was practically preserved at the initial level.

Significant individual differences were observed between the character of adaptation reactions of the investigators determined by different level of functional reserves of the organism, diapasons were determined of normal changes of the main indices of cardio-vascular homeostasis and vegetative regulation.

It was observed, that the parameters of biomechanics of respiration were within the frameworks of physiological norms, that pointed to stable external respiration in conditions of isolation. Ventilation and gas exchange at rest (in conditions of the main exchange) were preserved at the level of the background values. Emission of endogenous CO had daily fluctuations, depending on the motor activity, lungs ventilations and volume of buffer systems, remaining, at this in the frameworks of the physiological norm.

Investigation of the food status of the organism showed, that in conditions of staying in pressurized facility and the used food ration can be the reason for weight loss, changing of metabolism of carbohydrates, mobilization of subcutaneous fat with its concentration in liver, disbacteriosis of intestines, intensification of evacuation function of the stomach and slowing of the work of intestines.

During the isolation expressed decrease of the concentration of individual proteins – haptoglobin, α2-macroglobulin, and α1-antitrypsin was observed to restoration. It can be supposed that a significant role in development of protein composition of the blood plasma can be played by the factors and conditions of the habitat.

It was determined that contrast sensitiveness of the vision organ and directly connected with it space-frequency characteristics (SFC) are informative indices of interrelation between processing of visual information and psycho-physiological parameters of humans. Changes of psycho-physiological state were accompanied by corresponding changes of SFC of the vision organ, that can be used for neuro-information technologies of restoration of the functional state and working capacity of the operator, and also for management over the surrounding light-colour habitat.

For the first time efficiency was shown of the use of probiotic means, made on the basis of auto-strains of Enterococcus faecium on the principally new carrier – tablet absorbent carbon. During investigation of the influence of

auto-strains on microflora of intestines on humans in oligate form increase was observed of the quantity of bifid bacteria, enterococcus, not significantly – lacto bacteria. In the facultative flora decrease was observed of the content of S. aureus, E. Coli with the changed biochemical characteristics, Streprtococcus viridians, fungi-like fungi of Candida species, and also significant decrease of the quantity of mold fungi and gram-negative non fermentative rods.

Higher productivity of plants was observed, grown in the pressurized facility as compared to the laboratory control.

The results of the satellite investigation

For the first time simultaneously with 105-day pressurized chamber experiment long-term dynamic medical-ecological investigations were conducted of practically healthy people in 8 regions of the country and the world. The results of the investigations showed that staying in natural conditions of the habitat is characterized by more significant fluctuations of the indices of vegetative regulation of the cardio-vascular system, than staying in conditions of isolation, where the functional state of the organism is more stable and is preserved at the level close to the initial one for a long time.

During 45 days growing of plants was conducted in climatically pressurized chamber with small volume, the parameters of the habitat of which complied with the parameters of the habitat of one of the modules of the facility, where 105-day experiment was conducted. It was shown that cultivation of plants did not have any negative influence on the growth of plants and did not lead to deterioration of microbiological status in the chamber.

In the laboratory investigations – higher efficiency was shown – on time and energy volumes – of disinfecting of water with the use of SHF-energy as compared to its warm heating.

Microbiology

Investigation of microbiological markers of different substrates with the aim of development of technology of express-diagnostics of microbial status of humans and microbial contamination of artificial habitat.

In 105-day experiment with isolation of 6 investigators-volunteers in the pressurized facility:

- diagnostics of microbiological status of the investigators-volunteers was conducted;
- assessment of the species composition of microorganisms, conducted with the help of bacterio-logical and chromate-mass-spectrometry methods of detecting, showed prevailing of the later in decoding of the quantitative-qualitative spectrum of microflora;
- possibility was shown of creation of microbiological “passport” of humans with the aim of therapy and prophylaxis of infectious-inflammatory processes and disbacteriosis, that is especially important for biomedical support of interplanetary flights.

In 105-day experiment with isolation of 6 investigators-volunteers in pressurized facility advan-tage was shown of a new, easier in application method of contact prints for express-diagnostics of sanitary-microbiological state of the surfaces of the interior and equipment as compared to the nominal method of swabs from the surface. This method can be used for sanitary-microbiological monitoring of the habitat of a space ship and other pressurized facilities.

Psychology

In the scientific program of “Mars-105” experiment 22 research projects on psychology were included, submitted

by scientists from different countries: the USA (3 projects), Russia (12 projects), European Union (5 projects), Czech republic (2 projects). The main objectives solved in the frameworks of the proposed investigations were as follows: investigation of group aspects of adaptation to the simulated conditions of a flight to Mars, motivation and personal values of the crew members; investigation of peculiarities of communication with the external world in conditions of limitations of a Martian flight; investigation of the emotional state and mental working capacity of the crew members, dynamics of cognitive functions; investigation of the influence of the simulated conditions on the peculiarities of the operator's activity and professional reliability, on alertness and sleep-wakefulness regime; development of the system of psychological support of the crew.

The main results of psychological investigations, obtained in "Mars-105" experiment:

In-depth system of psychological selection of the crew was verified, including criteria of early diagnostics and prognosis of adverse personal dynamics, the use of which allowed to apply efficiently means of countermeasures and psychological support.

Criteria were approved of group selection and rational forming of the crew, taking into account limitations, typical for a manned flight to Mars. It was shown that application of the set of the selected methods of assessment of interaction in the crew allows to assess efficiently group behavior and diagnose existence of interpersonal problems in autonomous conditions. Recommendations were worked out for improvement of group selection during preparation of the experiment with 520-day isolation.

In "Mars-105" experiment automated content-analysis was conducted for the first time of reports of persons on duty, devoted to description of the implementation of the program and work of the equipment. It was shown, that the period of relative autonomy of the crew's existence with its determined limitations of communication with the Control center (first of all, of audio-communication) led to the increase of the volume of information, transferred in a form of written reports. In the reports for this period increase was observed of the number of utterances containing words of the category of "Activity", and also "Demands" and "Social regulation". Conclusion was made that autonomous existence, on the one hand, stimulated own activity of the crew, on the other hand – it was a problem for realization of life and activity of the group.

Recommendations were developed on organization of psychological support in the experiment with 520-day isolation, that should be unique for all the crew members, not depending on their affiliation to different space agencies. This will take into account individual characteristics of the crew. Principles were proposed of organization of information flows taking into consideration changes of communication regimes with the crew at different stages of simulation of a flight to Mars. Means of optimization of the functional state of the crew members and training devices for maintenance of skills of professional training of operators in autonomous conditions were approved successfully.

520-day isolation

The purpose of the experiment:

Investigation of interaction in the system «humans - environment» and obtaining of the experimental data about the state of health and working capacity of humans, staying for a long time in conditions of isolation in pressurized confined environment of limited volume during simulation of the main peculiarities of the Martian flight (over-duration, autonomy, changed conditions of communication with Earth - communication delay, limitation of expendable resources) and verification of technologies of medical support of cosmonauts as applied to interplanetary flights.

The main tasks of the experiment:

1. Investigation of the influence of conditions, simulating peculiarities of a manned Martian expedition on health and working capacity of the crew;
2. Organization of the activity of the crew and its interaction with the ground-based control center taking into account peculiarities typical for the Martian flight;
3. Verification of the principles, methods and means of control and monitoring of the habitat during over-long staying of the crew in conditions of confined pressurized facility;
4. Simulation of the activity of the crew on the surface of Mars and dynamic operations during the flight;
5. Verification of the principles, methods and means of control, diagnostics and forecast of the state of health and working capacity, improvement of means of providing of medical help and prophylaxis;
6. Improvement of the means of collection, processing and analysis of medical and physiological information;
7. Creation and approbation of reference-information system, providing activity of the crew, keeping and transfer of electronic information;
8. Verification of means and methods of telemedicine for distant control over the state of human health;
9. Approbation of methods and autonomous means of psychological support;
10. Assessment of modern technologies, systems and means of support of life and activity and protection of humans.
11. Implementation of the scientific program of the experiment

Structure of scientific investigations, conducted during 520-day isolation

Direction of investigations	Number of projects			Total
	Russian projects	Foreign projects		
		ESA	Other countries	
Physiological investigations	17	3	6	26
Psychological and psycho-physiological investigations	16	7	3	26
Biochemical, immunological and biological investigations	24	3	7	34
Microbiological and sanitary-hygienic investigations	7	1	-	8
Operational-technological experiments	10	1	-	11
Total	74	15	16	105

Candidates for participation in 520-day isolation

An international team chosen by the Institute of Biomedical Problems in Moscow, with the participation of the European Space Agency and the Asrtonaut Centre of China.

From Russia

Sukhrob Kamolov
physician crew

Alexey Sitev
crew commander

Alexandr Smoleevskiy
researcher

From European Space Agency

Romain Charles
flight engineer

Diego Urbina
researcher

From Astronaut center of China

Wang Yue
researcher

Kamolov Sukhrob Rustamovich - physician crew

Age: 37 years old
Permanent residence: Russia, Moscow.
Profession: surgeon.
Education: In 1996 graduated from Russian Military-medical academy named after S. M. Kirov (Saint-Petersburg), faculty of preparation of physicians of foreign armies. In 1997 finished internship on the specialty surgery. Candidate of medical sciences, in 2009 defended thesis on the theme: “Immediate and postponed results of prosthesis of aortal valve with frame xenopericardial prosthesis of “BioLAB” series”.
Experience: From 1990 to 1994 – studying on the treatment faculty of Tadzhikistan medical university. In 1994 he was transferred to Military-medical academy named after S. M Kirov. From 1998 he made operations in the Central military hospital in Dushanbe city. He worked in border regions of Tadzhikistan with Afganistan, he has experience of work with bullet and knife wounds. Since 2001 he worked in the department of oral surgery. From 2004 till 2006 he had residency training on cardio-vascular surgery in Scientific research center of cardio-vascular surgery named after Bakulev (Moscow). In 2006 he began post-graduate courses, finished them successfully and defended thesis in 2009. He worked in SRCCVS named after Bakulev and participated in operations on heart as the first assistant.
Sphere of scientific interests: physiology and pathophysiology of blood circulation, medical support and prophylaxis of diseases in conditions of long-term isolation.
Interests/hobbies: Cinema, theater, sports.

Sitev Alexey Sergevich - crew commander

Age: 38 years old
Permanent residence: Russia, Moscow region, Star city.
Profession: Engineer-shipbuilder.
Education: In 1996 graduated from Higher Military-naval engineering of Lenin’s order college named after F. E. Dzerhzhinskiy on specialty search-rescue and diving works, building of rescue and ship-raising means and ships (Saint-Petersburg).
Experience: From 1996 he served as the teacher-commander of platoon on the Black sea fleet (Sevastopol). During the time of service he learnt to work with all the types of diving equipment. He performed educational diving deep-water descending from the board of rescue ship “Epron”, he trained more than 250 junior specialists of Military-naval fleet on the qualification “deep water diver”. In 2004 he was transferred to MCC named after Y. A. Gagarin on the position of the leading engineer-investigator (senior diving specialist). He participated in training of ISS crews on extra-vehicular activity in conditions of simulated weightlessness in hydro-environment. He was the head of diving training of candidates for cosmonauts and members of the testing brigade.
Sphere of scientific interests: Improvement of life support systems, development of recommendations on activities of the crew in the struggle of functioning of the space station, development of technical means, facilitating for the cosmonauts exploration of the planet under investigation.
Interests/hobbies: Tourism, photo, diving.

Smoleevskiy Alexandr Egorovich - researcher

Age: 32 years old
Permanent residence: Russia, Moscow.
Profession: Military physician, physician of general practice, physiologist.
Education: In 2005 with honour graduated from Military-medical Academy named after S. K. Kirov, faculty of training of physicians for Military-Air Forces and Space forces. In 2006 finished internship on specialty “physician of general practice”.
Experience: From 2006 he was a researcher of scientific-research testing department of scientific-research testing center of aviation, space medicine and military ergonomics (SRTC ASM and ME). He is a specialist on medical support of tests of aviation sets and items of military technics, medical devices, apparatus and facilities. He dealt with the issues of increase of tolerance of human organism to unfavorable factors of environment and conditions of activity. Since 2009 he has been the head of laboratory of psycho-physiological investigations.
He investigated the problem of information interaction human-technical means.
Sphere of scientific interests: Biochemistry, pharmacology, physiology.
Interests/hobbies: Sports, fishing.

Wang Yue - researcher

Age: 27 years old
Country China.
Resides in: China PR. Beijing.
Current employment: Assistant for astronauts' teacher, working on environment adaptability training and selection .
Education:
2000-2005. Nanjing Medical College. Prevention Medicine.
2005-2008. Astronaut Center of China. Physiology.
Experience:
2008 - now. A.C.C. SZ-7 mission (astronaut training and selection). The second batch of Chinese preliminary astronaut selection.
Interests/hobbies: Basketball, football, swimming, reading.

Charles Romain - flight engineer

Age: 31 years old
Country: France
Resides in: Saint Malo, France
Current employment: Engineer.
Education:
Obtained a Master's degree in Engineering from the French Institute of Advanced Mechanics in Clermont Ferrand, France, which he attended from 1999 to 2004.
Experience:
Romain Charles has been working for Sotira (part of the SORA group of companies) since 2005. He is currently a Quality Manager for the company, which produces composite panels and has undertaken Quality Engineer roles within the company for the likes of Mclaren, Aston Martin and Tesla Motors. This followed a spell as a Quality Engineer for the automotive components company Mann+Hummel following graduation in 2004. This included working on projects for the Nissan company.
Interests/hobbies: books and cinema, the internet, swimming, running and scuba diving. He is also an active member of Junior Chamber International.

Urbina Diego - researcher

Age: 27 years old
Country: Italy
Profession: Engineer.
Education:
Urbina has Bachelor's and Master's degrees in Electronics Engineering from the Politecnico di Torino, in Turin, Italy and a Master's degree in Space Studies from the International Space University, in Strasbourg, France.
Experience: Diego Urbina was a crew member at the Mars Desert Research Station in Utah, USA in January 2010, researching the growth of tropical plants and spacesuit constraints. He was an Attitude and Orbit Control Systems researcher for the Aramis nanosatellite at the Politecnico di Torino in 2008.
Following graduation, Urbina spent time as an outreach and educational activity organizer in the developing world. Prior to this he was an operations and astronaut training intern at the Neutral Buoyancy Facility of ESA's European Astronaut Centre in Cologne, Germany from May to August 2009.
Urbina participated in the 'Image Reversal In Space' (IRIS) experiment for the ISS, supporting numerous measurements for baseline data collection and testing the experiment during ESA's 50th Parabolic Flight Campaign in 2009.
Interests/hobbies: Scuba diving, graphic design, drawing, fitness training and football.

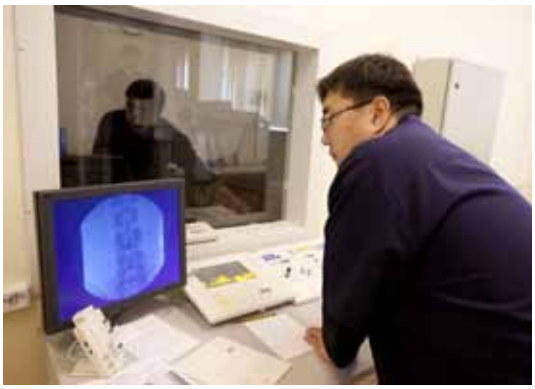
Medical selection















Survival training














Trying on «Orlan-E» space suit














Trainings at the «Paraflighter» test-bench






Base data collection





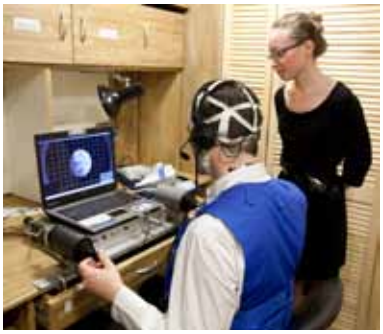




Training to experimental techniques











Training to experimental techniques







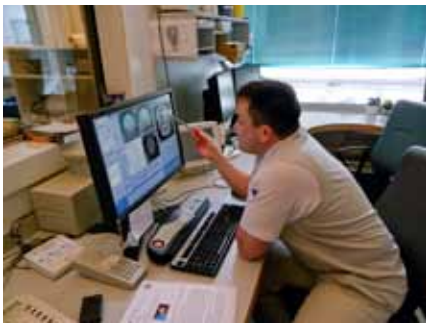







Training to experimental techniques















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