2.1 Construction and composition of the spacecraft
2.3 Communication
2.4 Life support system

1.2.1 System of cleaning carbon dioxide from the atmosphere ”Vozduh”

To remove carbon dioxide from the atmosphere of the ship we will use the Russian system ”Vozduh”, which was well-proven on the orbital space station ”Mir”. It is inferior to U.S. counterpart Carbon Dioxide Removal Assembly (CDRA) in performance, but showed greater reliability and maintainability.

The system is roughly divided into three main parts: pre-cleaner unit (PCU), unit heat exchangers (UHE) and the purification unit of the atmosphere (PUA). It consists of 3 rounds with molecular sieves, 2 silica gel cartridges, 2 electric heaters, gas-gas and gas-liquid heat exchangers, a vacuum pump, valves and eight of the fan. Desiccation of the system provides silica gel. Carbon dioxide from the atmosphere is removed by molecular sieves. The role of molecular sieves performs solid, porous adsorbent in the form of the zeolite. Principle of operation of molecular sieves is based on the action of capillary forces. The system performance depends on the absorption of CO2 from the air flow rate through the system, the duration of the adsorption and regeneration cycles, the concentration of CO2 in the atmosphere. After saturation of the zeolite it is regenerated in the outboard vacuum.

The system is virtually autonomous. It is working by spending air during communication zeolite cartridge with space vacuum. Air loss is not more than 0.2 kg per day. During the mission, it will not exceed 100 kg.

1.2.2 Chemical absorbers of carbon dioxide

Reserve for the removal of carbon dioxide on the ship will supply chemical absorbers based on lithium oxide. Absorptive capacity on a single cartridge of CO2 is 1600 liters, and the average person allocates 480 liters per day. On board there will be 20 of them, providing about 30 days of life of the crew, in the case of needed repairs in system ”Vozduh”.
1.3 Means for gas analysis

Means for gas analysis serve for continuous monitoring of the partial pressure of oxygen, nitrogen, carbon dioxide, water vapor, hydrogen and methane content in the atmosphere of the ship and issuing an alarm.

Given the experience of the ISS, as the analyzer in use is Major Constituent Analyser (MCA) - gas analyzer based on the mass spectrometer.

1.4 Controls tightness habitable compartments

Automatic pressure control in a vehicle is provided by the pressure sensor. It is submitting data to the UA and the crew with two manometers VC 316.

2. Means of water supply

Tools, designed for water supply:

- storage, filing and usability of drinking water in conditions of weightlessness;
- water regeneration from condensation of atmospheric moisture to meet the needs of the crew in the water and for cooking;
- regeneration of water from urine for use in the "Electron"
- ensuring crew sanitary water at the rate of 2 - 5 l/day per crew member

2.1 Water system on water supplies

Water reserve tanks onboard are situated inside and outside ATV lander. To use the water pumping unit is used.

2.2 System for water recovery from atmospheric moisture condensation

System for water recovery from atmospheric moisture condensation (SRV- K2M) produces quality water. It is intended for receiving a liquid mixture (LM) coming from the CTP system, cleaning and conditioning to a state separated liquid potable water distribution and hot water chilled drinking customers. SRV -K system is a permanent system. The crew receives water through the dispensing unit and heating in the hot and warm species. Water from the regeneration system is used for drinking, recovery sublimate products and juices, coffee, tea, as well as for hygiene procedures.

Condensation of atmospheric moisture, resulting in a residential bay IPC going on cold surfaces of heat exchangers, dryers CTP system. Then, in the form of LM, it comes in CPB -K for cleaning and drinking water.

Water passing through the ion exchange column with activated charcoal and the batch is purified from impurities contained therein. Then enters the saturation column salts (BKV)
and silver ions. Cleaning water from block columns is supplied through the open manual valve to the container and drinking water dispensing unit and the hot water (PDU). Heated water in the heater is performed in the CVT continuously or cyclically. Water is distributed through valves distribution unit PDUs with the inscription "Gor.", "Hol.". (Hot, Cold)

2.3 System for water recovery from urine

SRV-U - system for water recovery from urine, the principle of operation is based on a multi-stage evaporation of water from urine. Evaporation of the final products and the volume fraction of the source component for a crew member is in the Table 2. Urine in SRV-U comes from ACS to a preliminary treatment in the receiving system and preservation of urine (SPK-U).

Table 1: Evaporation of the final products and the volume fraction of the source component for a crew member

<table>
<thead>
<tr>
<th>Component</th>
<th>% of final product</th>
<th>Volume, l</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean water</td>
<td>96.8</td>
<td>1.55</td>
</tr>
<tr>
<td>&quot;Pickle&quot;, containing:</td>
<td>3.2</td>
<td>0.05</td>
</tr>
<tr>
<td>- water</td>
<td>70</td>
<td>0.035</td>
</tr>
<tr>
<td>- dry water</td>
<td>30</td>
<td>0.15</td>
</tr>
</tbody>
</table>

Thus, for a day one crew member has to 2.75 liters of water of 3.0 liters possible (of water recycled from urine and condensation of atmospheric moisture), and 0.25 l lost with the "pickle" (remnants of urine after processing SRV-U) and the solid waste. Spaceships "Shuttle" used vacuum dryers for solid waste destined for a complete regeneration of water. But in our case, because of restrictions on the weight and volume is appropriate to remove "pickle" and solid waste overboard in soft sealed package through a small airlock in the transfer compartment (PECVD ) of the IPC.

3. Electric food heater

Electric food heater (EFH) designed to heat the products in cans and foil packaging. Structurally heater consists of a heater unit automation and remote control. Cell placed inside the heater is for heating products. The heating elements within the cells are corresponding to the shape of food packaging. In the main module of the IPC on a folding table there are two food warmers. Heaters are connected to the side of an outlet. Time of heating products to T = 65°C (149°F) within 30 minutes. Heater is operated automatically. Styling products in the heater must be carried out on limiting depth cells. Any combination of products may be preheated - from one set (bank, bread) to four.
4. Sanitary facilities

Sanitary facilities (SF) are designed for the collection and storage of solid waste reception and conservation of liquid wastes of the crew. The equipment includes hygienic sewage disposals and water dispenser. Equipment is placed in sanitary compartment main module of the IPC.

4.1 Hygienic sewage disposals (WC)

The main elements of the sanitary sewage disposals device are:

- receiver of solid waste;
- urinal;
- dispenser preservative;
- a container with a preservative (sulfuric acid);
- flush water dispenser;
- dynamic separator of liquid mixture;
- container for urine;
- collector for urine and water;
- filter active components;
- fan;
- remote control (ACS);
- compressor (hand pump);
- water tank (EDV);

Transport of waste in devices is carried by air flow. Solid waste is retained in the porous insert airflow. Air is drawn into the fan through the orifices in the seat, extends through the container, the collection of urine and water absorption filter odors and emits again into the compartment. When you open the tap urine receiver (RC), it includes: separator, fan, pumps (dispensers) preservative and flushing water. When you close RK fan and pump (dispensers ) are turned off, the separator continues to operate for about 30 seconds. The used liner is placed into the solid waste container.

Urine is entrained in an air stream collector funnel and fed to a dynamic separator where the mixture of air, urine, sulfuric acid, and flush water is separated into liquid and gas phases. Airflow vapor separator passes urine collection from the urine and water, wherein a pair of the urine retained desiccant material, and the air enters the filter and then the absorption of odors emitted in the habitable volume of the fan.

Hand washing is performed in a chamber with a water supply tap manual. Water enters the chamber from the water displacement capacity of its EDV pressure created by a hand pump or compressor.

Used air and water are sucked from the chamber through the filter into the collector of urine and water, wherein water is retained in a porous material, and air passes through the filter and back to the habitable volume of the fan.
5. Means of fire detection and fire fighting

Amounts due to fire detection and fire include: fire detection system "Signal", portable fire extinguishers and insulating masks.

<table>
<thead>
<tr>
<th>System</th>
<th>Mass (summed with ZIP), kg</th>
<th>Power consumption, W/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Elektron&quot;</td>
<td>160(190)</td>
<td>550</td>
</tr>
<tr>
<td>&quot;Vozduh&quot;</td>
<td>205(255)</td>
<td>280</td>
</tr>
<tr>
<td>BMP</td>
<td>70(80)</td>
<td>50</td>
</tr>
<tr>
<td>CRV-K</td>
<td>180(520)</td>
<td>50</td>
</tr>
<tr>
<td>CRV-U</td>
<td>190(610)</td>
<td>50</td>
</tr>
<tr>
<td>ASU(CPK-U)</td>
<td>90(150)</td>
<td>5</td>
</tr>
<tr>
<td>TGK</td>
<td>(changable cassets 40 items) 40</td>
<td></td>
</tr>
<tr>
<td>$CO_2$ absorbers</td>
<td>(20 items) 20</td>
<td></td>
</tr>
<tr>
<td>The rest</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>In total</td>
<td>1965</td>
<td></td>
</tr>
</tbody>
</table>

2.6 Onboard computer system

The software of the laptop is meant for execution of the following tasks:
- provision of the required functionality for the conduction of some medical and the other scientific experiments;
- provision of the experiments processing facilities;
- provision of the crew with the appropriate tool for the updating of a flight log book;
- provision of the onboard systems control facilities.

The software of the EC is meant for execution of the following tasks:
- control of the onboard systems of the DC;
- collection of the telemetric data and the subsequent sending it to the MCC;
- provision of the telecommunication between the crew and the MCC during landing;
- DM’s engines control;
- transmission of the commands from the crew to the DC’s engines.

Failure-resistance

An appropriate rate of the CC’s failure-resistance is ensured by the so called three-channel redundant system. CC consists of three independent computers which solve all the set tasks concurrently. In the case of any divergence of results for two of three computers, the result, produced by two of three computers, is accepted. In case of the one computer’s breakdown, the so called two-channel mode starts, that is the tasks are being executed by two remaining
computers. When two computers failed, the proper functionality is to be provided by a single computer. After its breakdown the system reboots all the computers and comes back to the three-channel mode.

An appropriate rate of the CPC’s failure-resistance is ensured by another principle. CPC consists of three independent computers also. One of them performing the tasks in a normal mode, the other computer is switched (hot standby mode) in and ready to substitute the first one in case of its failure. The third computer is switched off (cold standby mode). It starts the hot standby mode in case of the second computer’s breakdown.

**Specifications**

Specifications of the modules of the OCS are given in the table below:

<table>
<thead>
<tr>
<th>Specifications</th>
<th>CC</th>
<th>CPC</th>
<th>Laptop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass (kg)</td>
<td>21</td>
<td>14</td>
<td>3.4</td>
</tr>
<tr>
<td>Power consumption (W)</td>
<td>110</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>Overall dimensions (mm)</td>
<td>480x295x160</td>
<td>220x300x310</td>
<td>214x117x83</td>
</tr>
<tr>
<td>Platform</td>
<td>ERC32 SPARC V7</td>
<td>ERC32 SPARC V7</td>
<td>Pentium 166</td>
</tr>
<tr>
<td>ROM/RAM (Mbyte)</td>
<td>4/8</td>
<td>250/4</td>
<td>1400/48</td>
</tr>
<tr>
<td>OS</td>
<td>VxWorks</td>
<td>VxWorks</td>
<td>Debian Linux</td>
</tr>
</tbody>
</table>

**Structure chart**
CC which is used on ISS has the similar specifications as the suggested configuration of the CC.

2.9 Medical training and medical briefing

1st day
1st meal: chicken meat with egg 1 can of 100 g, white bread 1 pack of 30 g, 1 package of chocolate refractory 50 g, peach apple juice 1 package 200 g, multivitamin pills "Aerovit" 1 tablet;
2nd meal: cottage cheese with apple puree 1 jar 100 g, gingerbread honey 1 pack 45 g, hazelnuts 1 pack of 25 g;
3rd meal: sturgeon natural one bank 100 g, 1 jar of caviar amateur 100 g, rye bread “Moscow” 1 pack 45 g dried apricots 2 packs of 50 grams, juice fruit mix 1 pack 200 g, multivitamin pills "Aerovit" 1 tablet;
4th meal: bream in spicy tomato - mustard sauce 1 can 100 g, bread table 1 pack 45 grams, jujube 1 pack 100 g, apple juice with pulp 1 pack 200 g

Total net mass: 1540 g
Total gross mass: 1724 g
Energy value: 2695 kcal
Proteins: 100.21
Fats: 69.43
Carbohydrates: 392.76

2nd day
1st meal: scrambled eggs with chicken 1 can of 100 g, white bread 1 pack of 30 g, apples with nuts 1 package of 60 g, peach apple juice 1 package of 200 g, multivitamin pills "Aerovit" 1
tablet;
2nd meal: cheese "Russian" 100 g, 2 packs of crackers 22 grams, sweet almonds 1 package 25 g;
3rd meal: perch in sauce "Baltika" 1 can 100g, spicy pork 1 can 100 g, bread “Borodino” 1 pack 45 g, sticks of apples and plums 2 packs 50 grams, juice fruit mix 1 pack 200g, multivitamin pills "Aerovit” 1 tablet;
4th meal: meat in white sauce 1 can of 100 g, bread table 1 pack 45 g, cookies "Vostok” 1 pack of 30 g, apple juice with pulp 1 pack 200
Total net mass: 1469 g
Total gross mass: 1658 g
Energy value: 2713 kcal
Proteins: 115.79
Fats: 97.76
Carbohydrates: 361.78

3rd day
1st meal: chopped pork with egg 1 jar 100g, white bread 1 pack 30g, prunes and nuts 1 package 60 g, peach apple juice 1 package 200g, multivitamin pills "Aerovit” 1 tablet;
2nd meal: cottage cheese with apple sauce 1 can 100 g, sugar cookies 1 pack 60 g, hazelnuts 1 pack of 25 g;
3rd meal: spicy walleye 1 jar 100g, meat jelly 1 jar of 100 g, bread Borodino 1 pack 45g, toffee 1 pack 50g, fruit mix juice 1 pack 200g, multivitamin pills "Aerovit” 1 tablet;
4th meal: chicken meat with prunes 1 jar 100g, cookies "Russian” 1 pack of 30 g, sticks of apples and apricots 2 x 50 g, rye bread “Moskovsky” 1 pack 45g Total net mass: 1345 g
Total gross mass: 1513
Energy value: 2678 kcal
Protein: 92.97
Fats: 90.32
Carbohydrates: 394.92

The total gross mass in three days: 4,895 kg.
4,895 * (501/3) = 817.465 kg
This weight is multiplied by two: we have two crew members.
Final weight: 1634.93 kg.
The total mass of products with packaging that is initially needed to take on board.

Cost per day diet astronaut: approximately 15,000 Russian rubles. Doubled - 30,000 Russian rubles.
Thus, at 501 one day cost $ 15,030,000 Russian rubles, or at the current rate - 423,977 U.S. dollars.

Diet comes from the following foods: canned bank number 1 with net weight 100 g to 1 jar of each item, including caviar amateur at TU 9161-382-04605473; minced pork with egg, meat in a white sauce, chicken meat with prunes, chicken meat and egg omelette with chicken on TU 9216-428-04605473; spicy pork and meat in jelly by TU 9216-407-04605473;
walleye piquant by TU 15-1211; bream in a spicy tomato sauce and mustard in walleye sauce "Baltika" by TU 15-35.04; cheese "Russian" by TU 862.7; cottage cheese with applesauce on TU 10.04.18.173; sturgeon natural GOST 7452; 3 juice packaging of each item with net weight 200 g, including juice apple juice with pulp and apple-peach by TU 10.04.18.174 juice and fruit mix of TU 9163-006-004782324 chocolates refractory to TU 9120-061-00334675 1 pack 50 g toffee and marmalade on TU 9130-417-04605473 on 1 pack with net weight 50 g and 100 g, respectively; sugar cookies and crackers at TU 9130-403-04605473 1 pack of 60 g and 2 packs of 44 g, respectively; cookies "Russian" and "Vostok" by TU 9131-419-04605473 1 pack with net weight 30 g sticks of apples and plums and apples from sticks and apricots RT MD 67-37685300-005 2 packaging of each item with net weight 50 g dried apricots by TU 9199-353-04605473 2 packs of 50 g prunes and nuts according to TU 10.04.18.198 1 pack 60 g apples with nuts on TU 10.04.18.122 1 pack 60 g hazelnuts and almonds sweet by TU 9196-413-046054732 packs of 25 g and 25 g of 1 pack respectively gingerbread honey, rye bread Moscow, white bread rich, bread and bread table Borodino by TU 9110-131-05747152 1 pack 45 g, 2 packs of 45 g, 3 packs of 30 g, 2 packs of 45 g and 2 packs 45 g, respectively, as well as multivitamin pills "Aerovit" by P 73,103,186 pills for each crew member.

These products are grouped by meals, as described above, and placed in the collective package.

Diet compared to a known power value is somewhat larger and somewhat shifted as compared with it a major nutrient value due to the relative increase in fat and decrease in relative content of carbohydrates. This is ensured by increasing the proportion of foods containing fat-soluble active compounds that support the immune status and stamina which compared with the conventional diet is more consistent with the needs of the human body under normal flight conditions of modern transport spaceship.

It should be noted additionally that the composition of the diet includes only those products that can withstand any transport, vibration, linear and shock loads in normal conditions of space flight on the transport ship, resistant to climatic influences and atmospheric composition of the cabin. Thus, the proposed diet largely meets the needs of the human body under normal flight conditions on the transport spaceship.
4.1 Leading out process

Figure 1.

5.1 Medical and biological experiments

Experiment “Biotest”

Biochemical mechanisms of metabolic adaptation to space flight. The aim of the experiment is to assess the state of biochemical status in conditions of weightlessness to study metabolic adaptation to prolonged space flight.

The experiment involves taking blood from a vein and finger directly during space flight, as well as in the background and post-flight periods. Collected in flight plasma and serum are to be returned to Earth in a frozen state. After delivery of the biomaterial to earth following
parameters are studied: antidiuretic hormone, atrial natriuretic factor, plasma renin activity, aldosterone, adrenocorticotropic, angiotensin 2, catecholamines, insulin, total protein, albumin, and electrolytes main osmotically active substance, as well as other biologically active substance and metabolites.

In an experiment conducted on the ISS following results were obtained: At the final stage of prolonged space flight the increase secretion of glucocorticoid and mineralocorticoid adrenal cortex, indicating the development of stress reaction, has not been seen. Functional association between indicators of sex hormones and pancreatic hormones during prolonged space flight saved.

Dynamics of changes in thyroid hormone levels before, during and after the flight reflects the state of metabolism, an adequate level of functional activity and basal metabolism in crew members in long-term effects of microgravity and other spaceflight factors while maintaining backward linkages in the regulation of thyroid hormone axis- thyroid hormones.

Dynamics of indicators of water-salt metabolism and its regulation correlated with age and duration of the flight crew members.

**Experiment ”Hematology”**

The study of morphological and functional properties of blood cells and the intensity of erythropoiesis in humans when exposed to space flight factors.

The aim of the experiment is to obtain new data on the impact of space flight on the human red blood system in order to expand its diagnostic and prognostic capabilities to identify mechanisms of changes in haematological indices (”space anemia”, lymphocytosis) and issuing recommendations on the need for prevention and pharmacological agents, correcting adverse effects of space flight and the early period of re-adaptation to terrestrial conditions.

The goals of the space experiment are:
- The study of hemoglobin content;
- Study of iron metabolism and maintenance of erythropoietin;
- The study of the metabolism of red blood cells and the state of the membrane;
- Study of the red blood cells shape;

In an experiment conducted on the ISS were found shifts in morphobiochemical red blood parameters, indicating the formation of a new level of erythropoiesis, with parameters typical for microgravity conditions.
Experiment "Octopus 2"
Study of the dynamics of body composition and distribution of human body fluids during prolonged space flight.

The purpose of the experiment: a study of the dynamics of body composition and distribution of human body fluids in conditions of prolonged space flight to evaluate adaptation mechanisms.

Goals:
1. Obtaining data on the dynamics of the body composition, including body fluids of human and their distribution in the extended space flight conditions.
2. Getting data for targeted correction of hydration status at various stages of the flight in order to increase efficiency of astronauts.
Obtained in the experiment on the ISS results suggest reducing hydration astronaut during prolonged space flight, while reducing the amount of lean mass and fat component of body weight.

Experiment "Parodont"
Investigation of periodontal tissues during prolonged space flight.

The goals of the experiment include: determining the concentration of immunoglobulins in the oral fluid, determination of the ratio of antibodies and pathogenic organisms, to study the nature of periodontal flora, develop prevention of periodontal disease.

It was found during the experiment “Parodont” that upon completion of spaceflight there are significant changes of local immunity and periodontal flora of the astronauts. All these changes are classified as risk factors for inflammatory diseases.

Condition of the organ of vision and intraocular pressure after the flight mission to Mars
The purpose of the study is investigation of the effect of long-term isolation on the state of the organ of vision and intraocular pressure man.

Before and during the first day after the end of a flight to Mars held- definition visual acuity, biomicroscopy with a slit lamp SL-45 company Shin-Nippon (Japan), direct ophthalmoscopy using a hand ophthalmoscope Vista-Professional Company Keeler (UK), a non-contact measurement of intraocular pressure tonometer AT555 company Reichert (U.S.), computed using a coherent retinotomography on the retinotomograph HRT-II firm Heidelberg Engineering (Germany) 22 with registration parameters of the optic disc.
In the experiment “Mars-500”, the ophthalmologic examination to insulation was installed in 4 surveyed refractive error (nearsightedness mild to moderate), 2 people were healthy, one of them took place in the past allergic conjunctivitis treated successfully Vizzini. When the ophthalmic examination of crew members on the first day after the 520-day isolation was made, negative dynamic visual acuity, eye refraction, intraocular pressure, and the parameters of the optic disk in comparison with survey data prior to the experiment, were observed.

Study of the spectral characteristics of the EEG alpha rhythm and indicators of dispersion mapping infarction during flight missions to Mars

The goal of the study is the impact of prolonged isolation on the main characteristics of EEG and morpho-functional state of the myocardium.

The instrument “CardioVisor”, which is the part of the complex “Ecosan-2007”, recorded background EEG and myocardial performance in the selection process to the mission, on the 1-2 day after its completion, and every 80 days during the flight. EEG analysis performed for bipolar leads (O2-P4, P4-C4, C4-F4 and O1-P3, P3-C3, C3-F3) occipital-parietal and front-central regions of each hemisphere after the filtration of the alpha rhythm. Figures calculated absolute power of the alpha rhythm (mV^2) assessment of the hemispheric interaction. In the study of myocardial recorded value indicators “Myocardium”, “Rhythm” and “Code of detail”.

In the experiment “Mars-500” were revealed the dynamics of which presupposes the predominance of sympathetic autonomic influence in the beginning of the experiment, which probably indicates a certain stress load, followed by reduction and adaptation indicators of all subjects under conditions of prolonged isolation.

Experiment “Immuno”

Study of neuroendocrine and immunologic changes during and after space flight.

The aim of the experiment is to study the neuroendocrine and immunological changes before, during and after the mission Inspiration Mars.

Goals:
• Receive a stress questionnaire and concentration of stress hormones in the fractions of daily urine for after the flight analysis of human psychoendocrinological regulation during space flight and their comparison with the data before the flight.
• Monitoring of immune system parameters before, during and after space flight.
• Preparation of biochemical data (content of substrates and metabolites of energy - glucose,
lactate) for the analysis of energy metabolism during space flight and their comparison with the data before and after the flight. Wi will have the results of studies of complex metabolism, its regulation, and the state of psychophysiological status of the immune system in conditions of prolonged space flight.

Experiment ”Chromatomass-spektr M”

Evaluation of microbiological status of the person by chromatography-mass spectrometry. The purpose of the experiment- a study of human microbiological status by chromatography-mass spectrometry.

Goals of the experiment:
- The formation of microbial “passport” of each astronaut;
- determination of the fullest spectrum of microorganisms using molecular markers of fat acid.

We assume the following sampling of blood and saliva: in period preflight- 3 times (60, 30 and 10 days before the start), in-flight- 5 times (7, 14, 30, 100, 170 night flight) shown in a post-flight- 3 times (2, 15, (if possible), and 45 days after planting). Canned samples on technology developed and delivered to the laboratory for analysis and interpretation of the data by the algorithm determining microecological status dysbacteriosis and infections by mass spectrometry of microbial markers.

The equipment used:
- Laying “GC- 1”; 250x190x60 mm, 1.0 kg;
- ASO “GC- 1”; 250x130x45 mm, 0.3 kg;
- Insert filters ”GC- 1”; 95x95x15 mm, 0.15 kg.

In the results of the research will help to make a first assessment of the impact of space flight on the quantitative composition of a wide range of microorganisms- representatives of commensal and opportunistic vatogeneric human florula and to determine methods and tooling for subsequent routine monitoring microecological and infectious status of astronauts at all stages of the flight mission.

Rating changes in the intensity of mineral metabolism of bone tissue during space flight by applying a sample of calcium 41S. Resorption of bone mineral composition of prolonged exposure to microgravity is an important issue for the organization of long-term space flight. Marking a living skeleton extremely rare isotope of calcium radiological 41Sa reveals small changes in the mineral composition of bone tissue by measuring the ratio of 41Ca/40Ca in urine using YMC- analysis. Research results showed that this method could be used to detect early changes in bone mineral metabolism of astronauts. Furthermore, the study can be combined with checking the effect antiresorptive agents during space flight and control the process of bone tissue restoration after returning to Earth.
Application of biogeoadaptogenes in long-term space flight

Geobioadaptogenes (GBA)- special natural compounds based on humic substances. Humic substances- a special class of natural compounds extracted from soils, sediments, peat, sapropel, coals and do not exist in living organisms, but necessary for the existence and continuity of the functioning of modern life forms.

The ability of the multifunction effects on living organisms is determined in the presence of biologically active components in these substances, including micro- and macroelements, a wide range of enzymes, amino acids, lipids, peptides, active acid and alkaline residues.

Adaptogenic properties of peat and drugs are confirmed by experimental laboratory studies and clinical observations. These include: limiting hyperfunction sympathetic nervous system, inhibition of lipid peroxidation, reflex action, aimed at normalizing the functional state of the organism. Such responses are capable of increasing the sustainability of living structures to hypoxia, cold, heat, physical- to manual ultrasonic inspection, stress, and increase physical and mental performance.

BYechnology currently allows to conduct targeted testing of finished products promising to apply it in space biology and medicine.

Autoprobiotics in the prevention of intestinal dysbiosis during mission Inspiration Mars

The aim of this work is to assess the effectiveness of drugs-autoprobiotics, based on strains of Enterococcus feacium, isolated from testers.

In the experiment “Mars-500” strains had the isolated from Enterococcus feacium 6 test, analyzed for the presence of pathogenicity genes. Those who were absent were selected to create probiotic products. Formulations were prepared as follows. Daily agar culture was aseptically washed off the agar surface with a minimum amount of saline solution, and then applied to a charcoal tablet last until saturation. The tablets were dried and used by operators 3 times a day, with each operator battered tablets containing its own strain Enterococcus feacium. Course of prophylactic administration of the drug for 60 days. Studies show very high activity of autoprobiotics. Upon graduation, the testers used other pro-and prebiotic drugs not based on autostrains. At the same time they found dysbacteriosis varying severity. Thus, on the basis of experimental data, we can conclude on the effectiveness autoprobiotics and prospects for their further use for the prevention of dysbacteriosis humans in an artificial environment.
Structure of experiments

During the mission, will be held 16 health biological experiments in the following areas:
- The study of adaptation of the cardiorespiratory system (4)
- Metabolism studies (6)
- Physiological-hygienic studies (2)
- Neurophysiological studies (1)
- Study of the functioning of the analyzer systems (1)
- Evaluation of prevention (2)

Moreover, the conclusion about the effect of space flight factors and the effectiveness of prevention will be formed on the basis of medical supervision.

6. Quick start guide

The composition of professionally significant physical qualities valued in the selection of candidates for the astronauts are: endurance, strength, speed, agility, flexibility. The results of the exercise are set for each evaluation exercise, physical quality and integrated evaluation of physical fitness that are mapped to the required level of preparedness. Grounds for rejection of candidates in the selection are:
- unsatisfactory level of physical fitness;
- minimum level of physical fitness in comparison with the other members of the competitive selection;
- smallest balance physical qualities at the same levels of physical fitness in a few participants competitive selection.

Applicants must meet the following requirements to the professional competence required for further training for space flight:
- have completed higher education in engineering or medical specialty;
- have work experience not less than five years of them - at least three years at the same place;
- have the necessary minimum of common knowledge in the fundamentals of manned space flight;
- have the ability to study space technology (to demonstrate the ability to understand the foundations and principles of construction of technical systems, to understand their physical nature, to be able to remember the technical information and specifications);
- have the ability to operator activity (determined by the results of specific tests). Applicants with experience in test work, take advantage of;
- English language skills (written and oral) must not be less than "good", with respect to the requirements of a high school for citizens of countries where English is the official language, and not less than "excellent " about high school requirements for citizens of countries where English is not the official language;
- ability to use a personal computer, Internet, email, antivirus programs, etc.;
have the necessary knowledge of the history of the world and austronatics of their motherland;
• have the necessary minimum of general knowledge in the field of cultural studies.

Position of the sequence and content selection procedures for the astronauts

1. Acceptance of applications and documents for the selection of applicants.

Competition Commission within the period specified in the notification about the selection of candidates for the astronauts takes statements and documents to participate in the selection of individuals. Each applicant must submit to the Tender Committee: an application for participation in the competition, a copy of your passport, containing information; characteristic of employment approved by the head of the enterprise, a copy of the Certificate of Secondary Education, a copy of diploma (s) of higher education and to extract estimates, a copy of the work book (if available) or a similar certificate of employment; autobiography, the contact information of the applicant (postal address, zip-code, phone, email, etc.) and copies of other significant terms of the applicant documents.

Applicants must also submit a set of medical documents: a copy of the outpatient medical records and the results of surveys: the total blood count, blood biochemical parameters (glucose, total cholesterol, triglycerides, bilirubin (total, direct, indirect), alanine aminotransferase, aspartate aminotransferase, gammaglutamil transpeptidase, total protein, prothrombin, amylase, creatinine, urea, C-reactive protein, serum iron), blood group, Rh factor, Wasserman, HIV, HbsAg, anti-HCV, the overall clinical analysis of urine, fecal total, triple research on eggs worms, fecal enterobiasis.

Bidder for this mission must fit into specialized anthropometric requirements, which differ from the standard (in brackets are the maximum allowable values of the corresponding parameters):
• an increase in the standing position (150-175 cm);
• growth in the sitting position (80-90 cm);
• body weight (50-75 kg);
• the maximum length of a foot (29.5 cm);
• maximum transverse dimension of the shoulder region (52 cm);
• maximum distance between the corners of the axillary (45 cm);
• the maximum width of the hips in the sitting position (41 cm).

In addition, the package of medical records must include the results and conclusions of the following instrumental examinations: electrocardiography at rest in 12-lead; chest radiography in 2 projections; ultrasound of the abdominal cavity, thyroid, kidney, pelvic organs; fibroezofagogastroduodenoscopy; ortopantomogramma; conclusions and results of examinations and clinical examinations by specialists: dentist, neurologist, ophthalmologist, surgeon, ENT specialist, therapist (for women - a gynecologist), and also the conclusion of tuberculosis, STI, substance abuse and psycho-neurological dispensaries.
2. Examination of documents by the Tender Committee.

Competition Commission shall review the submitted documents, including and the accuracy of the information contained therein, and eliminates applicants who do not meet the requirements of selection. The remaining applicants are subject to personal inspection (testing) to meet the requirements for professional competence.

Competition Commission makes a call bidders pre-qualified, the CPC to verify their compliance with the established requirements and organizes the work of its subcommittees on all kinds of selection.

3. Implementation of full-time professional selection procedures (testing).

3.1. Tackling health requirements for compliance.

Screening for appropriate medical standards include:
- examination of internal organs;
- neuropsychiatric research;
- Surgery Study
- ophthalmologic research;
- otorhinolaryngologic study;
- Dental Research;
- functional studies;
- gynecological examination (in the selection of women);
- psychiatric research.

Basic testing procedures and inspections are carried out on the basis of the candidates of the CPC. If necessary, these may involve experts from other organizations and agencies.

3.2. Tackling compliance psychological and moral and ethical requirements.

Psychological and moral qualities of applicants assessed by a special psychological research relevant interviews with applicants, studying documents describing their livelihoods, observations psychologists experts for candidates during the selection of other types.

3.3. Selection for eligibility to the level of physical fitness.

Evaluation of professionally significant physical qualities of bidders such as endurance, strength, speed, agility, based on the results verify that the applicants normative exercise. Physical fitness of applicants assessed under the following exercises:
• assessment of endurance: running 1 km (the result is not less than 3 min. 35 sec.), swimming crawl 800 m (the result of not less than 19 min. 00 sec.), 5 km ski race (the result of not less than 21 min. 00 sec.);
• estimation of the force: pulling on the bar (the result is not less than 14 times), flexion-extension in the palm of hands on the bars (the result is not less than 20 times), the angle-ups on the bars (the result is not less than 15 sec.)
• Assessment of speed: running 60 m (the result is not below 8.5 sec.), Shuttle run, 10x10 m (the result is not less than 26 sec.), Long jump with space (the result is not less than 2 m 30 cm), 25 swimming m (the result is not less than 19 sec.)
• Assessment of Agility: coordination, exercise on the trampoline (jumping with a 90, 180, 360 degrees, jump height not less than 60 cm), diving (jump - jumping head slump down, height 3 m);
• special physical preparedness: Sample Romberg active orthostatic test (exercise conditions are very simple and communicated to the applicant in the verification process), diving in length (the result is not less than 20 m);
• assessment of the prospects for airborne training physical exercise: jogging on a treadmill (time 11 min.) Hand veloergometry (time 3 min.).

3.4. Selection for eligibility to education and professional competence.

Applicants for selection must have the proper education and professional qualifications. Compliance to education and professional competence established by studying the relevant documents of applicants and verified during oral examinations and special tests.

At the end of the professional selection procedures Competition Commission analyzes the results of testing and examination candidates. Of the number of applicants that meet all the requirements necessary to be selected number of persons, specific criteria, with the best results for submission to the IAC.

IDC examines the documents and decides to endorse candidates for cosmonauts personally by each candidate and makes recommendations on their appointment "candidate astronauts engineers" or "candidate astronauts doctors" cosmonaut corps mission Inspiration Mars.

Solutions IAC selected candidates for the astronauts to be published on the website and communicated personally to all the selected candidates for the astronauts. At the same time, the refusal to approve an applicant in an open competition do not require special justification and communication with the candidate.

ANNEX number 1

A list of personal documents to be submitted by applicants to tender
In the competitive commission on each candidate (individual), the following documents:
1. application for participation in the competition;
2. copy of passport pages containing information;
3. characteristics of employment, approved manager of the enterprise;
4. copy of the Certificate of Secondary Education;
5. copy of the diploma(s) of higher education and discharge ratings;
6. copy of the work book (if available) or a similar certificate from the employer;
7. biographical data (autobiography);
8. Applicant contact information (mailing address, zip- code, phone, e-mail, etc.);
9. Other relevant documents of the applicant from the viewpoint of their copies.

ANNEX number 2

The list of medical documents submitted by the applicants
In the competitive commission on each candidate (individual), the following medical records:
1. A copy of the outpatient medical record.
2. The following assessments:
   • laboratory tests (total blood count);
   • blood biochemical parameters (glucose, total cholesterol, triglycerides, bilirubin (total, direct, indirect), alanine aminotransferase, aspartate aminotransferase, gammaglutamyl transferase, total protein, prothrombin, amylase, creatinine, urea, C-reactive protein, serum iron), the group blood type, Rh factor, Wasserman, HIV, HbsAg, anti-HCV, the overall clinical analysis of urine, fecal total, triple research on helminth eggs, feces enterobiasis study.
3. Anthropometric data (in brackets are the maximum allowable values of the corresponding parameters):
   • an increase in the standing position (150-175 cm);
   • Growth in the sitting position (80-90 cm);
   • body weight (50-80 kg);
   • the maximum length of a foot (29.5 cm);
   • maximum transverse dimension of the shoulder region (52 cm);
   • maximum distance between the corners of the axillary (45 cm);
   • the maximum width of the hips in the sitting position (41 cm).
4. Results and conclusions of the following instrumental examinations:
   • electrocardiography at rest in a 12-lead ECG;
   • chest X-ray in 2 projections;
   • ultrasound of the abdominal cavity, thyroid, kidney, pelvic organs;
   • fibroezofagastroduodenoscopy;
   • ortopantomogramma;
   • conclusions and results of examinations and clinical examinations by specialists: dentist, neurologist, ophthalmologist, surgeon, ENT specialist, therapist (for women - a gynecologist).
5. Conclusions from tuberculosis, STI, substance abuse and psycho-neurological dispensaries.
6. Each pair of final candidates must have the same blood group with the same Rh.

ANNEX number 3
Standards of physical exercise contenders

Physical fitness of applicants assessed under the following exercises:

- **Assessment of endurance**: running 1 km (the result is not less than 3 min. 35 sec.), Swimming crawl 800 m (the result of not less than 19 min. 00 sec.), 5 km ski race (the result of not less than 21 min. 00 sec.);
- **Estimation of the force**: pulling on the bar (the result is not less than 14 times), flexion-extension in the palm of hands on the bars (the result is not less than 20 times), the angle-ups on the bars (the result is not less than 15 sec.);
- **Assessment of speed**: running 60 m (the result is not below 8.5 sec.), Shuttle run 10x10 m (the result is not less than 26 sec.), Long jump with space (the result is not less than 2 m 30 cm), swim 25 m (the result of not less than 19 sec.);
- **Assessment of Agility**: coordination, exercise on the trampoline (jumping with a 90, 180, 360 degrees, jump height not less than 60 cm), diving (jump - jumping head slump down, height 3 m);
- **Special physical preparedness**: Sample Romberg active orthostatic test (exercise conditions are very simple and communicated to the applicant in the verification process), diving in length (the result is not less than 20 m);
- **Assessment of the prospects for airborne training physical exercise**: jogging on a treadmill (time 11 min.) Hand veloergometry (time 3 min.).

Grounds for rejection of candidates in the selection are:

- unsatisfactory level of physical fitness;
- minimum level of physical fitness in comparison with the other members of the competitive selection;
- smallest balance physical qualities at the same levels of physical fitness in a few participants competitive selection.