



**Committee on the Peaceful Uses of Outer Space
58th Scientific and Technical Subcommittee**

**SPACE MEDICINE
FOR THE EARTH MEDICINE**

60 YEARS OF THE FIRST HUMAN SPACEFLIGHT

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**Vienna - Moscow,
23 April 2021**



12 APRIL AS THE INTERNATIONAL DAY OF HUMAN SPACE FLIGHT



Resolution adopted by the UN General Assembly on 7 April 2011

The General Assembly,
Deeply convinced of the common interest of mankind in promoting and expanding the exploration and use of outer space, ...

Attaching great importance to international cooperation in peaceful space activities, ...

Recalling that 12 April 1961 was the date of the first human space flight, carried out by Mr. Yuri Gagarin, ... this historic event opened the way for space exploration for the benefit of all mankind,

...

Declares 12 April as the International Day of Human Space Flight to celebrate each year ... the beginning of the space era for mankind, reaffirming the important contribution of space science and technology in achieving sustainable development goals and increasing the well-being of States and peoples, as well as ensuring the realization of their aspiration to maintain outer space for peaceful purposes.



INTERNATIONAL COOPERATION OF IBMP





PROSPECTIVE JOINT PROJECTS

- **Human Mars, Lunar, asteroids missions**



- **Spin-off**

- **BioCosmos**



ISS



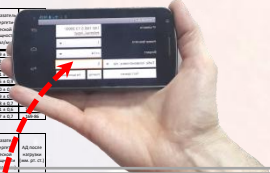
- **Education**

PHYSIOLOGY OF A HEALTHY PERSON

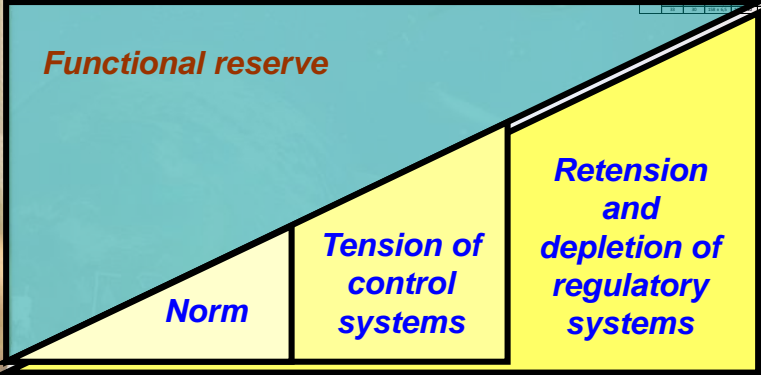
- Study of physiological norm
- Study of functional reserves of the human body
- Study of mechanisms of adaptation to the effects of various environmental factors
- Development of mass donosological survey methods



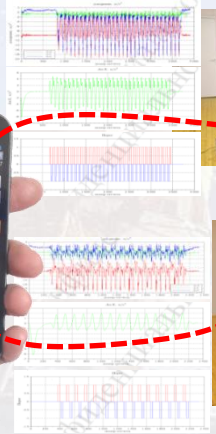
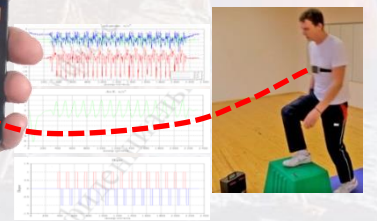
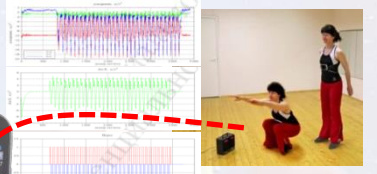
Время (мин)	Частота сердечных сокращений (ЧСС)	Артериальное давление (АД)	Сатурация кислорода (SpO2)	Температура тела (Тт)	Уровень лактата в крови (Lactate)	Уровень лактата в моче (Lactate)	Уровень лактата в поте (Lactate)	Уровень лактата в слюне (Lactate)	Уровень лактата в моче (Lactate)	Уровень лактата в поте (Lactate)	Уровень лактата в слюне (Lactate)
11:00	70	120/80	98	36.5	1.0	0.0	0.0	0.0	0.0	0.0	0.0
12:00	75	125/85	98	36.6	1.5	0.0	0.0	0.0	0.0	0.0	0.0
13:00	80	130/90	98	36.7	2.0	0.0	0.0	0.0	0.0	0.0	0.0
14:00	85	135/95	98	36.8	2.5	0.0	0.0	0.0	0.0	0.0	0.0
15:00	90	140/100	98	36.9	3.0	0.0	0.0	0.0	0.0	0.0	0.0
16:00	95	145/105	98	37.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0
17:00	100	150/110	98	37.1	4.0	0.0	0.0	0.0	0.0	0.0	0.0
18:00	105	155/115	98	37.2	4.5	0.0	0.0	0.0	0.0	0.0	0.0
19:00	110	160/120	98	37.3	5.0	0.0	0.0	0.0	0.0	0.0	0.0
20:00	115	165/125	98	37.4	5.5	0.0	0.0	0.0	0.0	0.0	0.0
21:00	120	170/130	98	37.5	6.0	0.0	0.0	0.0	0.0	0.0	0.0
22:00	125	175/135	98	37.6	6.5	0.0	0.0	0.0	0.0	0.0	0.0
23:00	130	180/140	98	37.7	7.0	0.0	0.0	0.0	0.0	0.0	0.0
24:00	135	185/145	98	37.8	7.5	0.0	0.0	0.0	0.0	0.0	0.0
25:00	140	190/150	98	37.9	8.0	0.0	0.0	0.0	0.0	0.0	0.0
26:00	145	195/155	98	38.0	8.5	0.0	0.0	0.0	0.0	0.0	0.0
27:00	150	200/160	98	38.1	9.0	0.0	0.0	0.0	0.0	0.0	0.0
28:00	155	205/165	98	38.2	9.5	0.0	0.0	0.0	0.0	0.0	0.0
29:00	160	210/170	98	38.3	10.0	0.0	0.0	0.0	0.0	0.0	0.0
30:00	165	215/175	98	38.4	10.5	0.0	0.0	0.0	0.0	0.0	0.0
31:00	170	220/180	98	38.5	11.0	0.0	0.0	0.0	0.0	0.0	0.0
32:00	175	225/185	98	38.6	11.5	0.0	0.0	0.0	0.0	0.0	0.0
33:00	180	230/190	98	38.7	12.0	0.0	0.0	0.0	0.0	0.0	0.0
34:00	185	235/195	98	38.8	12.5	0.0	0.0	0.0	0.0	0.0	0.0
35:00	190	240/200	98	38.9	13.0	0.0	0.0	0.0	0.0	0.0	0.0
36:00	195	245/205	98	39.0	13.5	0.0	0.0	0.0	0.0	0.0	0.0
37:00	200	250/210	98	39.1	14.0	0.0	0.0	0.0	0.0	0.0	0.0
38:00	205	255/215	98	39.2	14.5	0.0	0.0	0.0	0.0	0.0	0.0
39:00	210	260/220	98	39.3	15.0	0.0	0.0	0.0	0.0	0.0	0.0
40:00	215	265/225	98	39.4	15.5	0.0	0.0	0.0	0.0	0.0	0.0
41:00	220	270/230	98	39.5	16.0	0.0	0.0	0.0	0.0	0.0	0.0
42:00	225	275/235	98	39.6	16.5	0.0	0.0	0.0	0.0	0.0	0.0
43:00	230	280/240	98	39.7	17.0	0.0	0.0	0.0	0.0	0.0	0.0
44:00	235	285/245	98	39.8	17.5	0.0	0.0	0.0	0.0	0.0	0.0
45:00	240	290/250	98	39.9	18.0	0.0	0.0	0.0	0.0	0.0	0.0
46:00	245	295/255	98	40.0	18.5	0.0	0.0	0.0	0.0	0.0	0.0
47:00	250	300/260	98	40.1	19.0	0.0	0.0	0.0	0.0	0.0	0.0
48:00	255	305/265	98	40.2	19.5	0.0	0.0	0.0	0.0	0.0	0.0
49:00	260	310/270	98	40.3	20.0	0.0	0.0	0.0	0.0	0.0	0.0
50:00	265	315/275	98	40.4	20.5	0.0	0.0	0.0	0.0	0.0	0.0
51:00	270	320/280	98	40.5	21.0	0.0	0.0	0.0	0.0	0.0	0.0
52:00	275	325/285	98	40.6	21.5	0.0	0.0	0.0	0.0	0.0	0.0
53:00	280	330/290	98	40.7	22.0	0.0	0.0	0.0	0.0	0.0	0.0
54:00	285	335/295	98	40.8	22.5	0.0	0.0	0.0	0.0	0.0	0.0
55:00	290	340/300	98	40.9	23.0	0.0	0.0	0.0	0.0	0.0	0.0
56:00	295	345/305	98	41.0	23.5	0.0	0.0	0.0	0.0	0.0	0.0
57:00	300	350/310	98	41.1	24.0	0.0	0.0	0.0	0.0	0.0	0.0
58:00	305	355/315	98	41.2	24.5	0.0	0.0	0.0	0.0	0.0	0.0
59:00	310	360/320	98	41.3	25.0	0.0	0.0	0.0	0.0	0.0	0.0
60:00	315	365/325	98	41.4	25.5	0.0	0.0	0.0	0.0	0.0	0.0



Decrease in functional reserves



Tension growth of regulatory systems



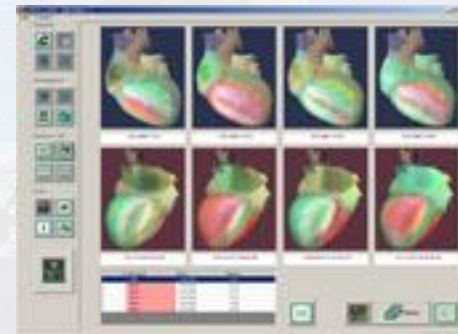


EXPRESS-DIAGNOSTICS AND SCREENING OF PUBLIC HEALTH



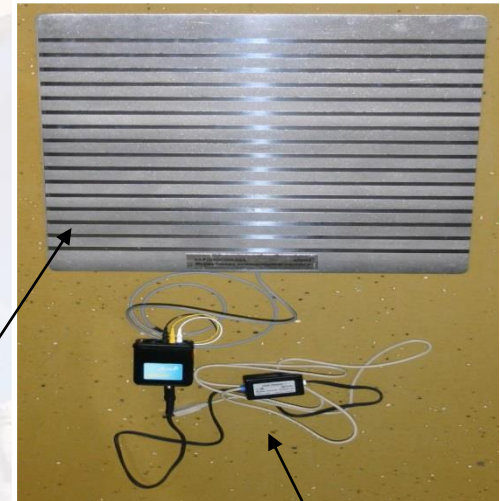
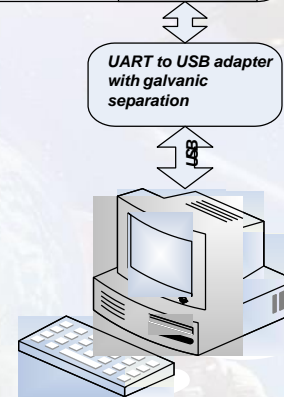
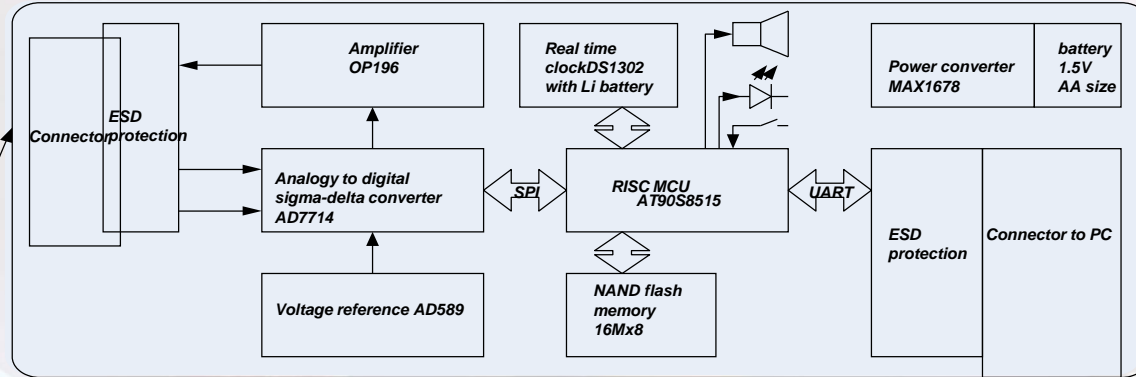
ECOSAN

- used in prenosologic monitoring of populations health in 10 regions of the world;
- used for examination of transport drivers, civil pilots, subjects in on-ground experiments with different stress effects;
- deployment time is no longer than 15 minutes.





EXPRESS-DIAGNOSTICS AND SCREENING OF PUBLIC HEALTH



CARDIOSON

- developed on the basis of space device Sonocard for the contactless recording of physiological signals during sleeping;
- could be useful not only for preventive medicine but also for sport and labor medicine.

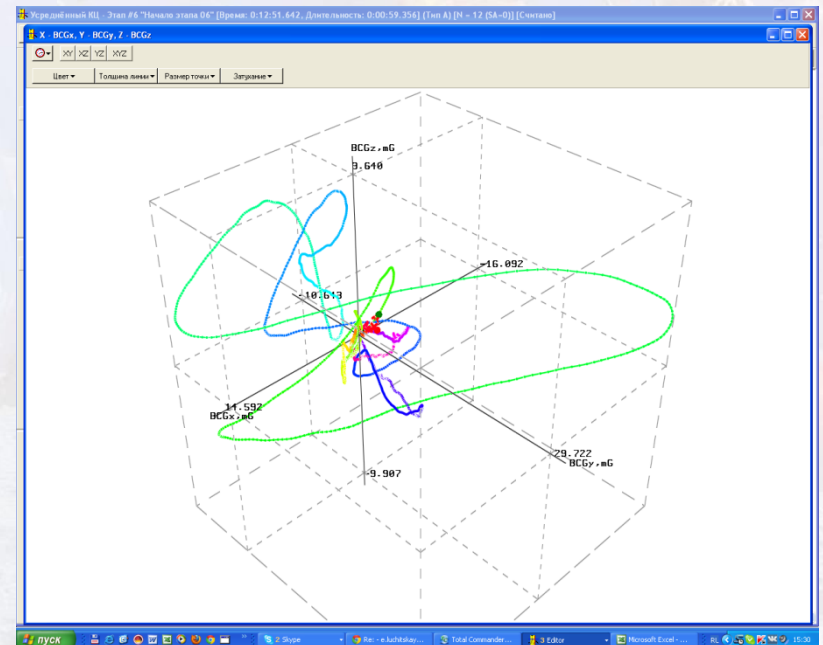
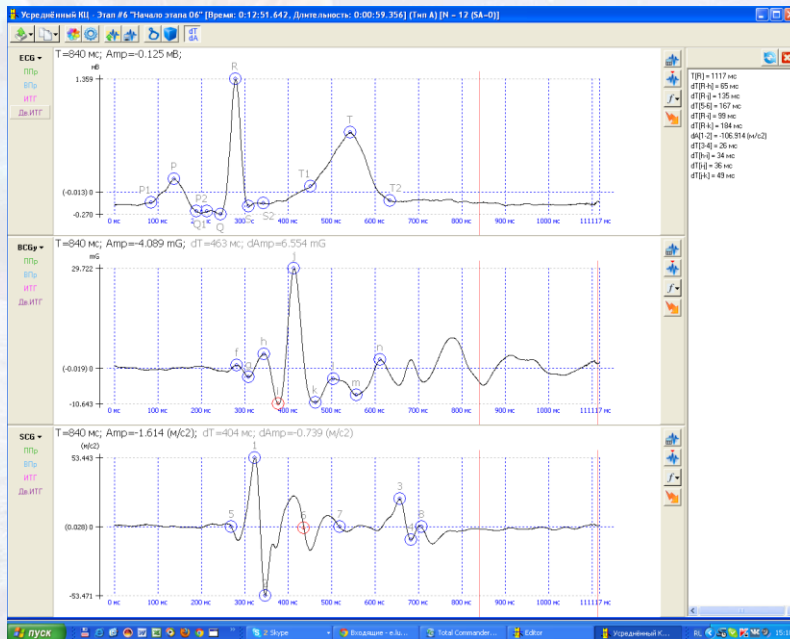
The transducer arranged under the pillow or mattress

Data storage

CARDIOVECTOR



It may be very useful in rehabilitation management of such diseases as cardiac infarction, therapy of chronic coronary sclerosis, control of the cardiac strain in athletes. Quantification of the cardiac pump force and work opens up new vistas for individualized dosing of medications and physiotherapy.





ADOPTION OF NEW TECHNOLOGIES FOR REHABILITATION

Loading suit «Regent» – effective rehabilitation of stroke, brain trauma and children cerebral palsy rehabilitation

- ❑ Correction of functional alterations of posture and gait (ongoing studies in 5 leading Russian rehabilitation centers);
- ❑ Increase of physical training tolerance (more than 1500 patients);
- ❑ Increase of life quality and social activity.





ADOPTION OF NEW TECHNOLOGIES FOR REHABILITATION

COMPENSATOR OF SUPPORT UNLOADING «KORVIT»

Effective rehabilitation of consequences of ischemic stroke, brain and spinal trauma, children cerebral palsy, long term immobilization of patients of different nosologies.

Main effects:

- Non-invasive activation of brain cortex areas responsible for gait;
- Normalization of muscle tone in lower extremities;
- Countermeasure of venous insufficiency;
- Activation of bone consolidation mechanisms.





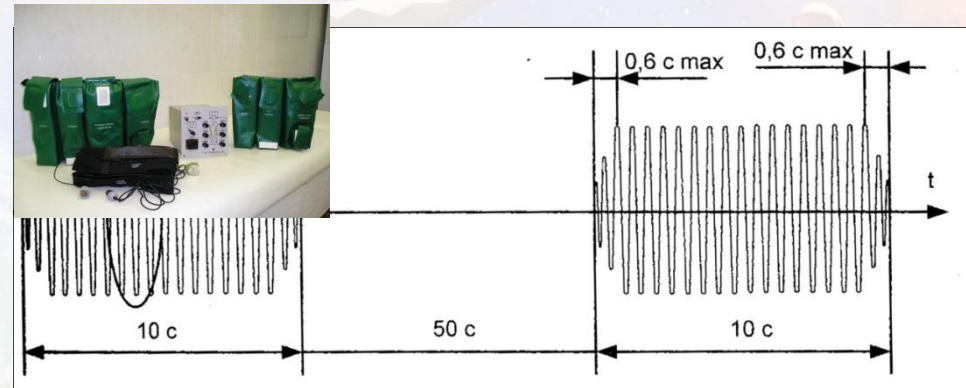
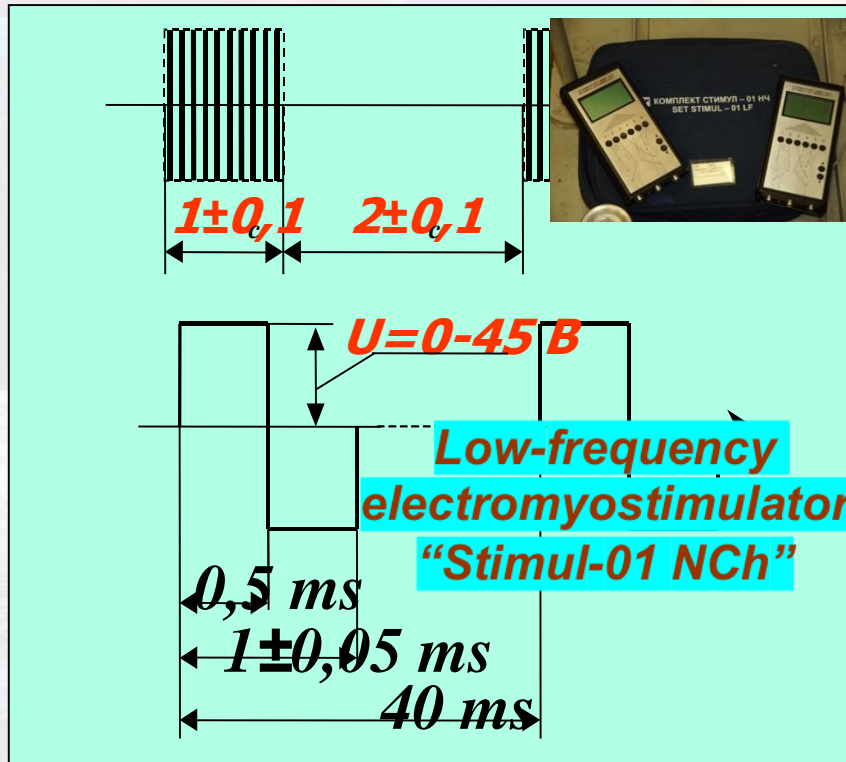
ADOPTION OF NEW TECHNOLOGIES FOR REHABILITATION

Low frequency electromyostimulation (under development)

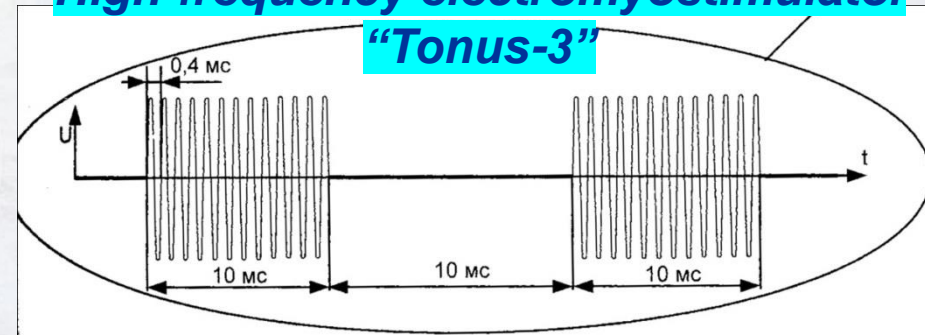
Stimulation is directed to the slow, tonic muscle fibers (maintaining postural stability). The efficacy is tested in clinical medicine for heart failure patients.

High frequency electromyostimulation (under development)

Effective for strength training of phasic muscles. Current studies are dedicated to the possibility of usage in elder people and patients with hear failure.



High-frequency electromyostimulator "Tonus-3"





ADOPTION OF NEW TECHNOLOGIES FOR TREATMENT & REHABILITATION

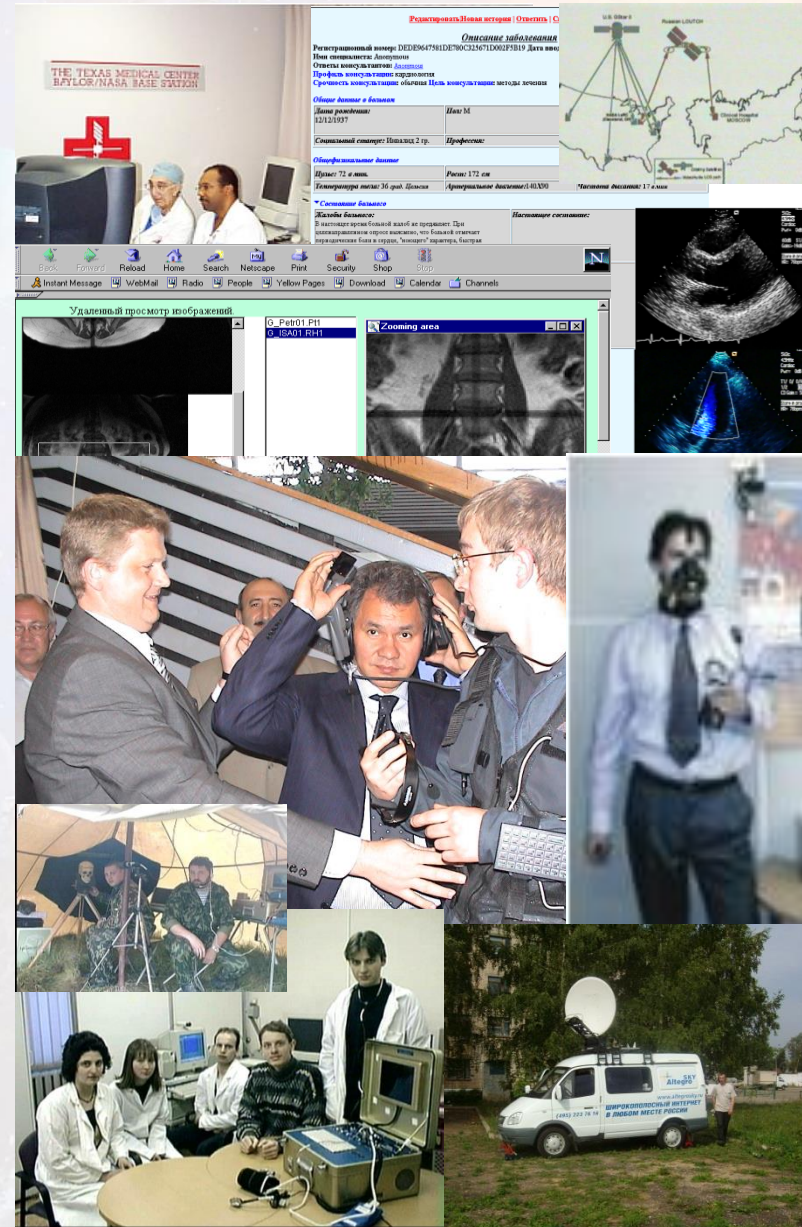
Development and manufacture of instruments and devices for implementation of innovation treatment technologies and techniques using gas mixtures consisting of oxygen and inert gases.





TELEMEDICINE

- **International projects** («Telemedicine in Russia» etc.).
- **Development of Telemedicine Internet technologies** (“on-line” and “off-line”).
- **Development and implementation of a strategy for telemedicine services and their legal support.**
- **Building the foundation for Telemedicine education and training.**
- **Development of mobile and off-site telemedicine technologies.**

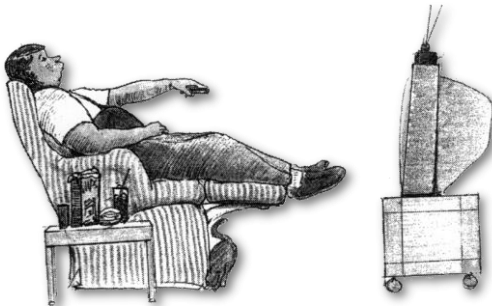




HYPOKINESIA

SOCIETY

- **Technological progress:**
 - Automation and mechanization;
 - Emotional and mental stresses against the background of inactivity;
 - Economy class syndrome



CLINICAL PICTURE

- Limited locomotion of bed patients;
- Hypokinesia syndrome process should be taken into account when dealing with an underlying disease;
- Pharmacodynamics changes in bed patients



SPACE

- Hypokinesia and hypodynamia in flight;
- **Simulation studies:**
 - Phenomenology of causes and mechanisms of disorders;
 - Countermeasures, correction and rehab technologies



CONSORTIUM

- Pavlov Institute of Physiology RAS (**IP RAS**) (**COORDINATOR**)
- Institute of Biomedical Problems RAS (**IBMP RAS**)
- Sechenov Institute of Evolutionary Physiology and Biochemistry (**IEPB RAS**)
- St. Petersburg Electrotechnical University "LETI" (**ETU «LETI»**)



**PAVLOV CENTER
«INTEGRATIVE PHYSIOLOGY TO
MEDICINE, HIGH-TECH
HEALTHCARE AND
TECHNOLOGIES OF STRESS
RESISTANCE»**

TASKS: Obtaining new knowledge in the field of integrative physiology and creating scientifically based innovative technologies for the progress of medicine, health care and the development of stress-resistance technologies

PLANNED OUTCOME

IP RAS

- Stress research
- Neurotechnologies
- New technologies of neurorehabilitation
- Biological and social foundations of inclusion
- Physiology and genetics of memory
- Pain research
- Brain and the regulation of feeding behavior studies

IEPB RAS

- Molecular mechanisms of disorders of the hypothalamic-pituitary system in metabolic disorders, pharmacological correction
- Technologies of optogenetic rehabilitation of the retina subjected to neurodegenerative processes
- Search for new ligands of ionotropic glutamate receptors of NMDA and AMPA types and study of the molecular mechanisms of their action

IBMP RAS

Establishment of a Center for the study and prevention of the effects of long-term isolation

ETU "LETI"

- Creation of a complex model for ensuring the interoperability of methods for physiological data processing
- Development of methods for non-invasive diagnostics of the body state, its monitoring and correction
- Development of technologies for software and hardware modeling of neuroprocesses

non-invasive technologies for neuromodulation of human motor and visceral functions

methods of prevention and treatment of stress-induced diseases, stress resistance technologies

recommendations for the composition of the hardware and software complex of psychological support for astronauts

new analgesic drugs, laser therapy method for the treatment of pain syndromes of various etiologies

drugs for the treatment of Alzheimer's disease, prevention and treatment of hyperphagia and obesity, as well as ways to correct metabolic syndrome and diabetes

approaches for optogenetic retinal prosthetics

diagnostic systems based on Artificial intelligence for processing information that characterizes the state of the human body, and making decisions using a mathematical apparatus

advanced technologies for hardware modeling of neuroprocesses, models of cognitive processes for building strong artificial intelligence



'HE CALLED US ALL INTO SPACE'

NEIL ARMSTRONG

