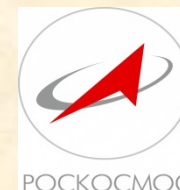




UNITED NATIONS
Office for Outer Space Affairs



Российская Академия Наук



INTERNATIONAL COOPERATION IN PROJECTS OF BIOLOGICAL SATELLITES BION-M

Rakov D.V., Ilyin E.A., Sychev V.N.
SRC of RF IBMP of RAS

United Nations / Russian Federation Workshop on Human
Capacity-Building in Space Science and Technology for
Sustainable Social and Economic Development

Samara, Russian Federation, 30 October – 2 November 2017

BIOLOGICAL INVESTIGATION ON BOARD AUTOMATICALLY SPACE CRAFT



Rockets flight

Since from 1951 – to 1960 r. Was 34 rocket launches with dogs

Duration of gravity : 3,7-10,0 minutes

Biological objects: dogs, mice and etc.

Altitude of rockets : 100-473 км

Modify Spaceship Vostok

Since from 1960 r. to 1961 r. - 4 satellite

Duration of flight : 1,5 – 29 hour

Biological objects : dogs, rodents, insects, microorganism

Bion program

Since from 1973 to 2013 12 biosatellites in space

Duration of flight: 5 - 30 days

Objects : rats, monkey, microorganism, insects, worms, cell culture and tissue, fish, reptiles, amphibians, plants, egg of birds

Biological experiments in Foton-M №2 mission

Data of launch : May 31, 2005

Duration of flight : 16 days

Biological objects: geckos, snails, microorganisms

Biological experiments in Foton-M 3 mission

Date of launch : September 14, 2007 r.

Duration of flight : 12 days

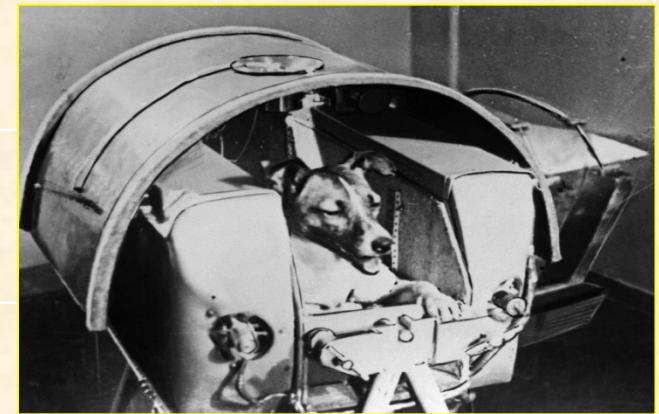
Biological objects: mongolian gerbils, tritons, geckos, snails, microorganisms.





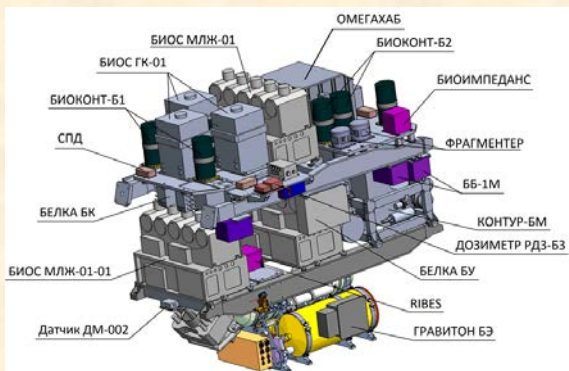
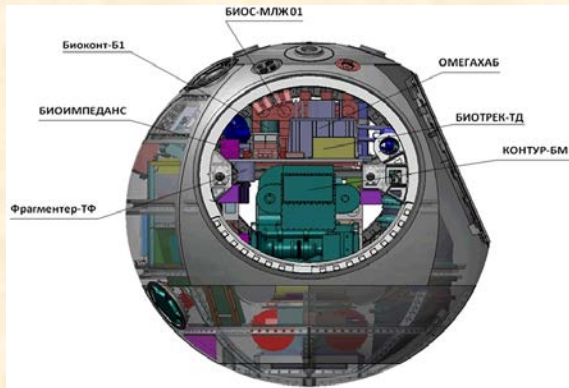
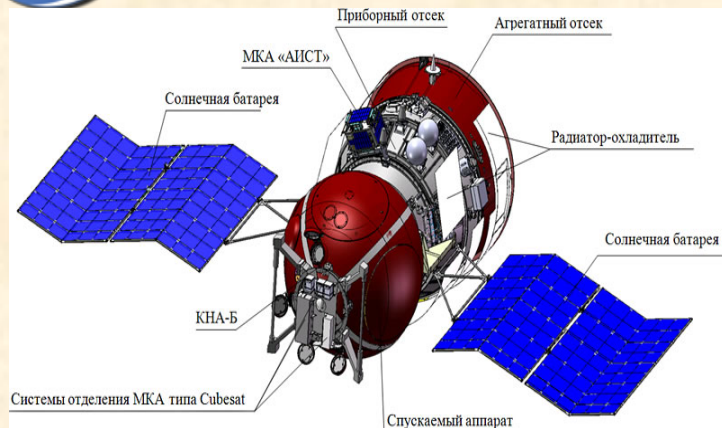
SCIENTIFIC RESULTS WITH DOGS FLIGHT ON ROCKETS

Type of Rockets	Date of lunch	Number of starts	Duration of microgravity (min)	Registration parametres
Rocket R-2A (altitude 100-110 km)	1951	6	3,7	- Heart rate
	1954	3		- ECG
	1955	3		- Arterial pressure
	1956	3		- Skin temperature
Rocket R-2 (altitude 212 km)	1957	5	6,0	- Breathing rate
	1958	2		- Behavior
	1959	2		
	1960	2		
Rocket R-5 (altitude 450-473 km)	1958	3	10,0	



59 dogs flight on rockets, some of them flights twice. Experiments show that organisms was survive on different stages: starts, during shot period of microgravity, and returned to the Earth.

Biosatellite	Biological objects on biosatellite	Orbit		Flight duration (days)
		Apogee	Perigee	
Bion– 1 /«Kocmoc-605»/	Rats, turtles, Drosophila melanogaster, flour meal, fungi, microorganisms	424 km	214 km	21,5
Bion – 2 /«Kocmoc -690»/	Rats, turtles, Drosophila melanogaster, seedlings, microorganisms, seeds	389 km	223 km	20,5
Bion – 3 /«Kocmoc-782»/	Rats, turtles, fish, Drosophila melanogaster, cell culture, seedlings, crustacean eggs, seeds, fungi	405 km	227 km	19,5
Bion – 4 /«Kocmoc-936»/	Rats, Drosophila melanogaster, seedlings, fungi	419 km	224 km	18,5
Bion – 5 /«Kocmoc-1129»/	Rats, Drosophila melanogaster, eggs of birds, fungi, cell cultures	406 km	226 km	18,5
Bion – 6 /«Kocmoc-1514»/	Monkey, rats, seedlings, plants	288 km	226 km	5
Bion – 7 /«Kocmoc-1667»/	Monkey, rats, plants, cell culture, protozoa	297 km	222 km	6,9
Bion – 8 /«Kocmoc-1887»/	Monkey, rats, fish,insects, protozoa	406 km	224 km	13
Bion – 9 /«Kocmoc-2044»/	Monkey, rats, fish, insects, cell culture	294 km	216 km	14
Bion – 10 /«Kocmoc-2229»/	Monkey, seedlings, cell culture	372 km	216 km	12
Bion – 11	Monkey, seedlings	375 km	217 km	15
Foton-M №2	Microorganisms, amphibians, reptiles, crawfish	302 km	261 km	16
Foton-M №3	Mongolian gerbils, microorganisms, snails, amphibians, reptiles	304 km	262 km	12



The parameters of the working orbit	575 км
Inclination	64,9°
Spacecraft mass	до 6400 кг
The mass of scientific equipment:	
placed inside the lander	- 650 кг
placed outside the lander	- 250 кг
Power supply:	
the average daily consumption providing equipment	- 650 watt
the average daily consumption scientific equipment	- 550 watt
Active lifetime in orbit	30 days + 1
Space rocket	«Soyuz-2» (1a or 1b)
Launch site	Baikonur



THE ADVANTAGES OF RESEARCH ON BOARD AUTOMATIC SPACE VEHICLES

- Greater selection of research to solve scientific problems (internal layout, launch date, mission duration orbital parameters, the return capsule, etc.);
- Carrying out scientific experiments and studies, which for various reasons can not be implemented on Board existing manned spacecraft;
- Flexible planning run, depending on the readiness of the experiments and research;
- The possibility of returning large volume of biological material from different orbits and the possibility of conducting a comprehensive survey of modern laboratories;
- Lower cost for training and research compared to the cost of manned spacecrafts;
- Wide international scientific cooperation in developing scientific research programs and establishment of scientific equipment.

GRAVITATION BIOLOGY AND PHYSIOLOGY

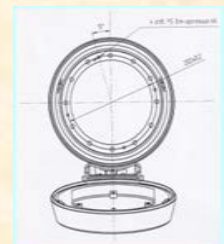
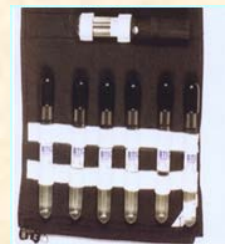
EXO BIOLOGY

PROBLEMS OF CLOSED ECOLOGICAL SYSTEMS

RADIO BIOLOGY AND SPACE DOSIMETERS

PHARMACOLOGY

BIOTECHNOLOGY





SCIENTIFIC COOPERATION IN BION-M 1 PROJECT



1. Institute of physiology. I. P. Pavlova, RAS
- 2-3. Institute of Higher Nervous Activity and Neurophysiology of RAS
4. Institute of Theoretical and Experimental Biophysics of RAS
5. Institute of crystallography. A.V. Shubnikov RAS
6. Institute of Cytology and Genetics of the Siberian Branch of RAS
7. Institute of Microbiology of the RAS by S.N. Vinogradsky
8. Kazan Institute of Biochemistry and Biophysics of the KSC of RAS
9. Institute of physicochemical and biological problems of soil science RAS
10. Institute of evolutionary physiology and biochemistry. I. M. Sechenov, RAS
11. Institute of biochemical physics. N. M. Emanuel RAS
12. Institute of cell Biophysics, RAS
13. Institute of biology of development. N. To. Koltsov, RAS
14. Institute of Cytology, RAS
15. The Polar-Alpine Botanical garden-Institute N. Avrorina KSC, RAS





THE RAMS INSTITUTES, UNIVERSITIES AND ACADEMIES INVOLVED IN THE IMPLEMENTATION OF THE PROGRAM OF FUNDAMENTAL AND APPLIED EXPERIMENTS AND RESEARCH ON THE PROJECT "BION-M" № 1



16. Research Institute of human morphology, RAMS
17. Institute of General pathology and pathophysiology, RAMS
18. Research Institute of biomedical chemistry of them. V. N. Orehovica, RAMS
19. Research Institute of normal physiology. P. K. Anokhin, RAMS
20. Joint Institute for nuclear research
- 21-29. Moscow state University. M. V. Lomonosov
30. Research Institute of pharmacology named after V. V. Zakusov RAMS
31. Saint Petersburg state University
32. Kazan (Volga region) Federal University
33. Moscow state medico-stomatological University
34. Kazan state medical University
35. Yaroslavl state medical Academy,
36. Izhevsk state medical Academy
37. Voronezh state medical Academy named after N. N. Burdenko
- 38. Samara state medical University**
- 39 Samara State Aerospace University**
40. Institute of applied and fundamental medicine of the State educational institution of higher professional education "Nizhny Novgorod state medical Academy"
41. National Research Center "Kurchatov Institute"





FOREIGN UNIVERSITIES AND ORGANIZATIONS INVOLVED IN THE IMPLEMENTATION OF THE PROGRAM OF FUNDAMENTAL AND APPLIED EXPERIMENTS AND RESEARCH ON THE PROJECT "BION-M" № 1



Ukraine:

1. Institute of Zoology im. Schmalhausen NAS of Ukraine

Germany:

2. DLR
3. University of Hohenheim
4. University of Erlangen
5. Medical University Charité, Berlin, Germany

USA:

6. *Ames Research Center, NASA*
7. The University Of New South Wales
8. University Of Florida, Gainesville,
9. University of health and scientific research of Oregon
10. University of California, San Diego
11. Medical Institute of Geffen,
12. University of California, Los Angeles
13. Medical center of the University of Connecticut, Farmington
14. Medical center University of Kansas, Kansas city
15. Washington University, St. Louis
16. State University of Utah
17. NASA

France:

18. The Institute for space medicine and physiology, Toulouse, France

South Korea

19. Institute of advanced radiation technologies (ARTI) at the Korean research Institute of atomic energy (KAERI), Republic of Korea

Japan

20. Research Institute for bioresources Okayama University





CONDITIONS OF WORK WITH BIOLOGICAL OBJECTS ON COSMODROME AND LABORATORY





WORK WITH BIOLOGICAL OBJECTS AT THE LANDING SITE





RESULTS OF THE BION-M 1 PROJECT



After a 16-year hiatus in the flights of biological satellites, the infrastructure was re-created and a new team of young specialists from different institutes and industrial enterprises was formed, capable of solving tasks of such complexity and scale.

New scientific cooperation has been created, which includes more than 40 Russian institutes of the Russian Academy of Sciences, Russian Academy of Medical Sciences, Universities and Medical Academies from most regions of Russia, as well as cooperation with leading foreign universities and scientific institutions from Ukraine, Kazakhstan, Germany, France, Bulgaria, USA.

An experimental base has been created, including a bench, to conduct research of this scale; methods have been developed and developed that allow, using modern hardware, to conduct, at the cellular and molecular genetic levels, in-depth studies of the intimate mechanisms of the response of biological matter to the effects of space flight factors and their consequences for the animal organism.





ГНЦ РФ – ИНСТИТУТ МЕДИКО-БИОЛОГИЧЕСКИХ ПРОБЛЕМ РАН

Проект «БИОСПУТНИК»

Биомедицинские эксперименты и исследования
на российских автоматических космических аппаратах



Блог

Видеоблог

Программа "Биокосмос" >

"Бион-М" №1 >

"Бион-М" №2 >

"Бион-М" №3 >

Яндекс

В начало

Новости

☐ О проекте

☐ Программа "Биокосмос"

Гравитационная биология

Гравитационная физиология

Радиобиология

Космические биотехнологии

Наземная подготовка

Библиография

Руководство

Исторический обзор

Участники программы

Награды и патенты

☐ Космические аппараты

☐ Планируемые программы

☐ Выполненные программы

Образовательная программа

Конференции

☐ Публикации в СМИ

Фотогалерея

Биоэтические аспекты

Загрузки

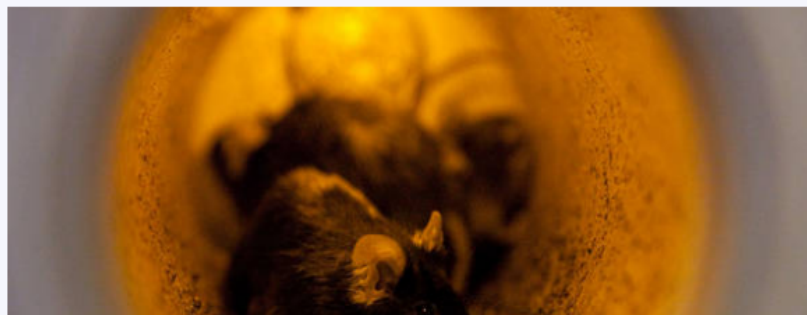
Ссылки

Контакты

О проекте "БИОСПУТНИК"

Освоение человеком космического пространства неразрывно связано с проведением исследований в области космической биологии и физиологии, в том числе на борту пилотируемых и беспилотных космических аппаратов. Эти исследования позволили изучить фундаментальные закономерности функционирования живых систем в условиях измененной гравитации и действия других факторов космического полета. Полученная информация, в свою очередь, эффективно используется для реализации глобальной программы освоения человеком космического пространства – решения фундаментальных проблем космической биологии, биотехнологии и физиологии, а также совершенствования системы медицинского обеспечения космических полетов человека.

Фотогалерея



Новости

2011

С 9 февраля 2011 г. начаты биолого-технические испытания научной аппаратуры «МЛЖ-01-01». Испытания прошли в Санкт-Петербурге на базе предприятия-изготовителя научной аппаратуры ФГУП СКБ «Биофизприбор» ФМБА России. Научная аппаратура «МЛЖ-01-01» предназначена для проведения биомедицинских экспериментальных исследований на мелких лабораторных животных (МЛЖ) - мышах и гекконах в условиях микрогравитации. Аппаратура включает в себя блок исследования и обеспечения индивидуального свободного содержания 15-ти мелких лабораторных животных – мышей линии C57bl, группами по три особи, а также блок исследования и обеспечения содержания гекконов в течение космического эксперимента продолжительностью до 36 суток.

2010

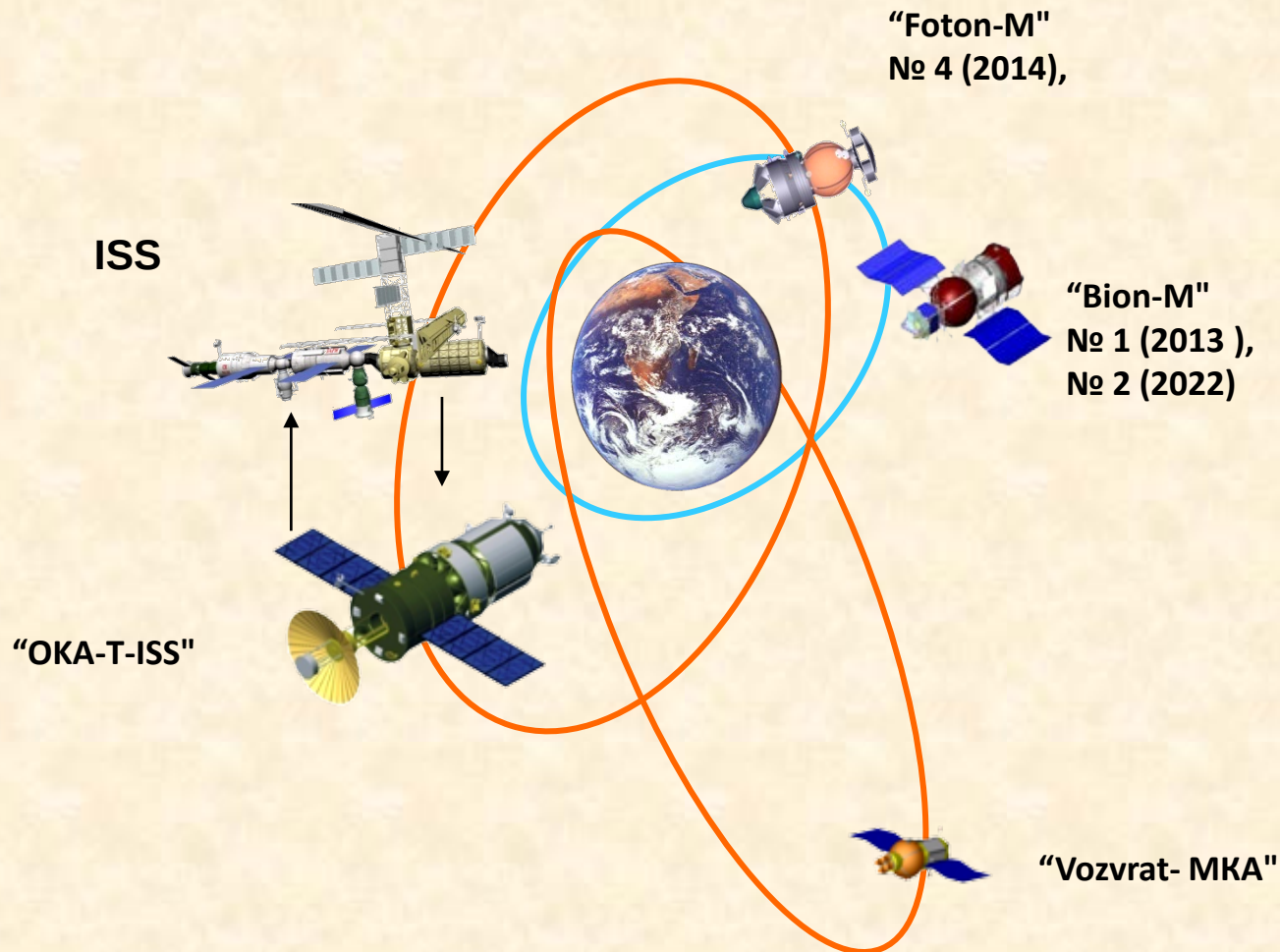
С 5 ноября по 3 декабря 2010 г. на стендовой базе ГНЦ РФ-ИМБП РАН были проведены биолого-технические испытания

RU

Ru



SPACE VEHICLES FOR FUNDAMENTAL AND APPLIED RESEARCH IN ORBITAL FLIGHTS



OKA-T-ISS - automatic spacecraft for 5 years of flight with periodical docking with ISS;

Foton-M, Bion-M – automatic spacecrafts for biomedical and technological research in flights up to 60 days and more;

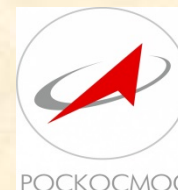
Vozvrat-MKA – small sized automatic spacecraft for flights on low and high elliptic orbits with recovery of space capsule to the Earth.



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Российская Академия Наук



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(12.12.1918 – 17.11.2007)

Russian Soviet physiologist,
academician, one of the
founders of space medicine

SRC of RF-IBMP of RAS organize
international conference "Space
biology and aviation medicine"
Moscow, 10-12/12/18. Conference
dedicate to 100 anniversary of
O. Gazenko.

