Committee on the Peaceful Uses of Outer Space
Scientific and Technical Subcommittee
Fifty-seventh session

SIRIUS 20/21:
THE UPCOMING 8-MONTH MISSION

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Vienna, 3–14 February 2020

EXPERIENCE OF PROLONGED SPACE FLIGHT PROGRAM «SALYUT», «MIR» AND «ISS»

«Salyut-7»

Berezovoy A.N., Lebedev V.V.
May 14 - February 12, 1982
211 days

Kizim L.D., Soloviev V.A., Atkov O.Yu.
February 7 - October 2, 1984
237 days

«Mir»

Romanenko Yu.V.
February 5 –
October 29, 1987
326 days

Titov V.G., Manarov M. Kh.
December 21, 1987
- December 21, 1988
365 days

Krikalev S.K.
May 11, 1991 -
March 25, 1992
311 days

Polyakov V.V.
January 8, 1994
- March 22, 1995
437 days

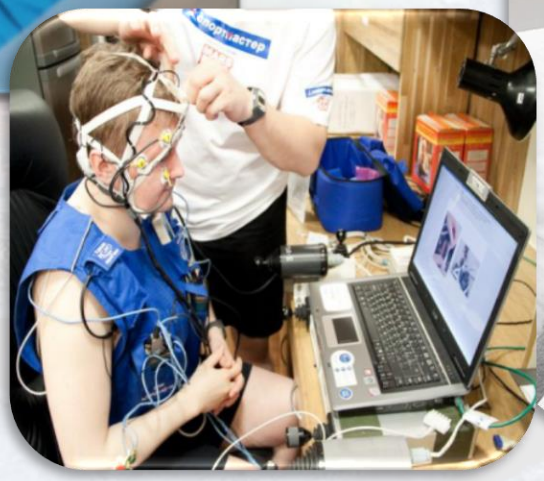
Avdeev S.V.
August 13, 1998 -
August 28, 1999
379 days

ISS

Kornienko M.B., Scott J.Kelly
March 27, 2015 – March 02, 2016
340 days

MAIN SIMULATION EXPERIMENTS AT IBMP

- Clinostatic hypokinesia
- Head-down hypokinesia
- Dry immersion
- Centrifuge-generated g-loads, experiments using SRC and slow rotating rooms
- Long-duration isolation
- Testing medical instruments and technologies in spacecraft mockups



WHY ISOLATION?

- Monotony
- Artificial Environment
- Sensor Deprivation
- Limited Recourses
- Night Shifts
- Hypodynamia

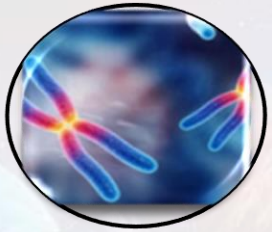
Isolation

Extreme Isolation Factors affect on human Organism

WHY ISOLATION?

High Fidelity and duration-scalable ("Dose-Effects")

Isolation is a good Platform for:



Fundamental Studies

Applied Research

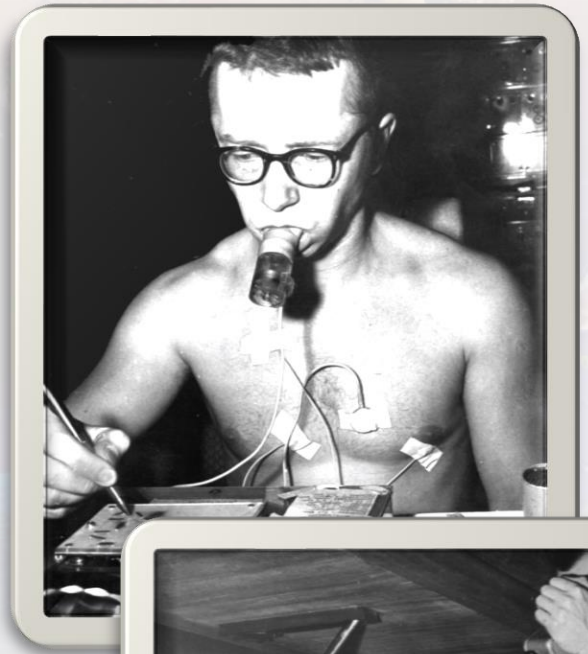
- ✓ Find new Stress-related Parameters on molecular Level
- ✓ Investigate the Interaction between different physiological Systems of the Human Organism
- ✓ Explore the Mechanisms of Adaptation of Human Organism to Isolation Conditions

Test New laboratory Equipment to be implemented to the ISS and then to an interplanetary Spacecraft in limited Volumes by Layman

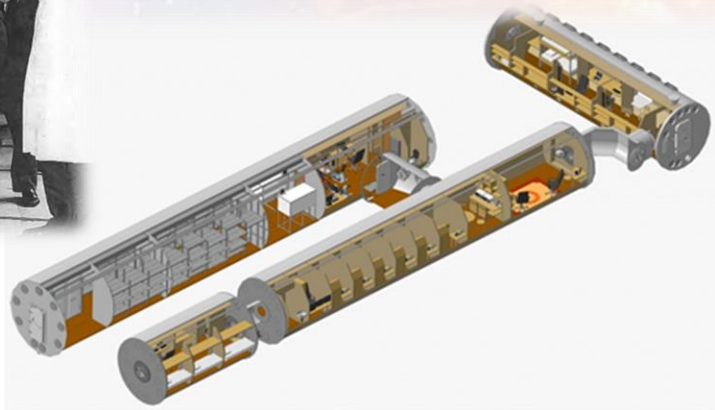
Test new effective Countermeasures

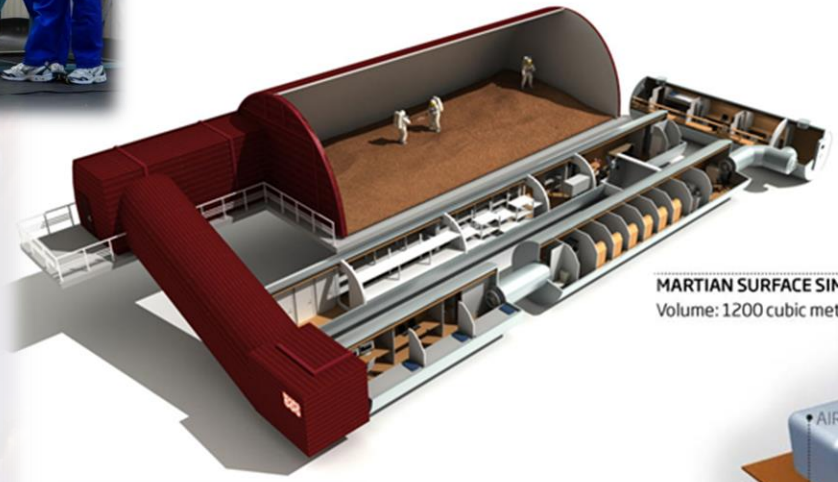
ONE YEAR IN TERRESTRIAL STARCRAFT

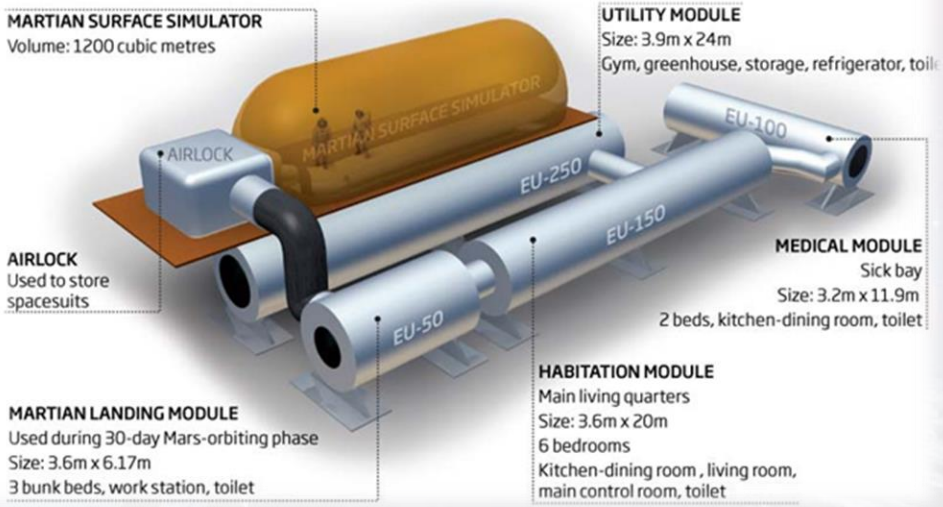
One-year experiment with exposure of three male volunteers (physician G.A. Manovtsev, commander, biologist A.N. Bozhko, and technician B.N. Ulybyshev) in artificial environment. (November 5, 1967 - November 5, 1968)



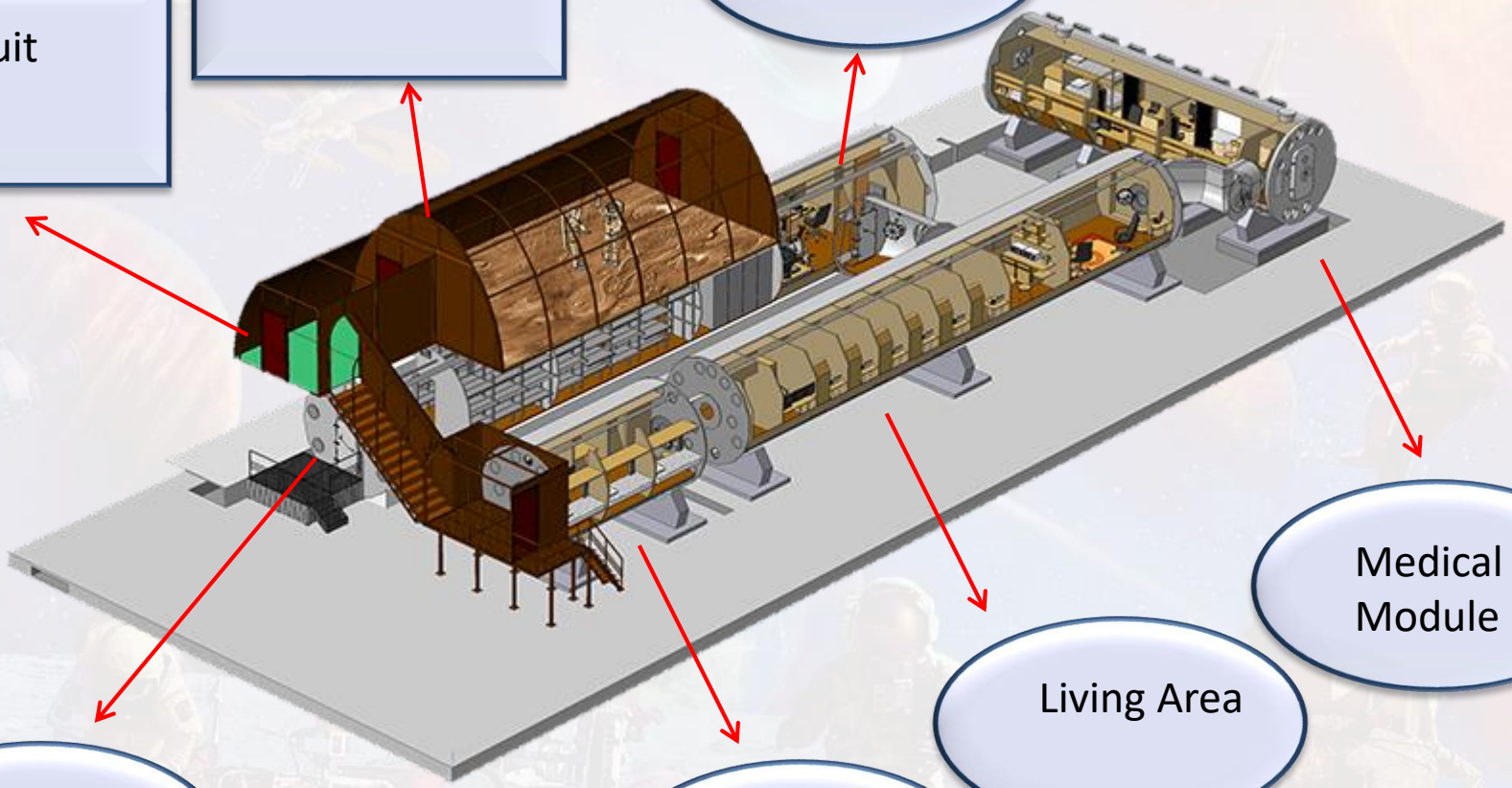
THE GROUND TEST FACILITY (NEK) - 1971







IBMP ISOLATION UNITS



HUBES-94 EXPERIMENT - SIMULATION OF A 135-DAY "EUROMIR-95" MANNED SPACEFLIGHT

The objective of the HUBES simulation was to better prepare for the EUROMIR-95 joint space Mission - 135-day flight by a European astronaut on board the Russian orbital "Mir" complex was scheduled for 1995.

- To compare and validate Russian and European methods and tools for use in crew selection, training, monitoring and in-orbit support flight;
- To select those most appropriate for possible application during a real long-duration spaceflight (e.g. EUROMIR 95);
- To collect data from subjects that can be regarded as control group data for the subsequent inflight study.

31 studies were selected for the HUBES experiment, proposed by research groups from the France, Germany, Italy, the Netherlands, Norway, Czech Republic, Russia, Switzerland, the United Kingdom and the United States of America in the areas of : individual performance, group behavior, chronobiology, physiology, neuro-immunology, nutrition and flight operations.

INTERNATIONAL EXPERIMENT SFINCSS - 99

SIMULATION OF THE FLIGHT OF INTERNATIONAL CREW TO SPACE STATION, 1999-2000, 240 DAYS

Human subjects in the experiment were 21 volunteers from Russia, Germany, Canada, France and Japan who made investigations for PIs from 9 countries: Russia, Austria, Germany, Canada, Norway, USA, Czech Republic and Sweden.

OVERALL RESULTS:

- **Facts about the effects of long-term isolation and confinement on crew psychophysiology and performance.**
- **Trends in the body systems adaptation to artificial environment**
- **New data on interactions within international crew were embodied in methods of psychological support of cosmonauts in the course of training for and during space mission.**
- **Trial application of biomedical hardware and instruments before integration into the space crew medical care system.**
- **Contribution to solving some issues of medical support of multinational ISS crews.**

MARS-500 PROJECT

Goals:

- **study the human adaptation to simulated peculiarities of future manned mission to Mars.**
- **study the biomedical requirements for support of extra prolonged orbital manned and interplanetary missions**

Duration of experiment: 520 days

Crew: 6 males in age 25-38 years old from different countries

Provided conditions:

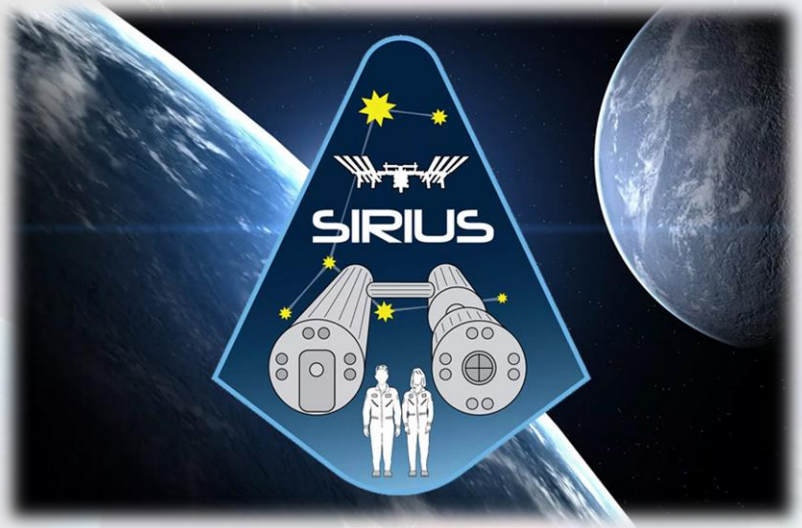
- **isolation in fully hermetical medico-engineering complex consisting of 5 segments with total volume 550 m^3**
- **autonomous function of complex and crew**

Dates of experiment: June 3, 2010 – November 4, 2011

«LUNA-2015»

SIRIUS PROJECT

Scientific International Research In Unique Terrestrial Station



The SIRIUS project will simulate long duration space missions to study issues related to human isolation and confinement. This includes the study of biomedical and psychosocial challenges that may be experienced during long missions.

The study will be conducted over a period of several years at the NEK isolation facility located in IBMP, Moscow, Russia.

Participation by researchers around the world will be a key aspect of this collaborative effort.

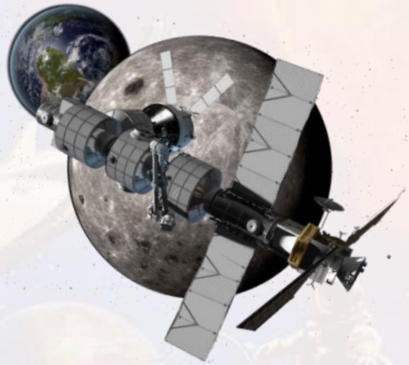
GROUND-BASED EXPERIMENTS – THROUGH ISS TO DEEP SPACE

MARS 500

SIRIUS

International Space Station

Deep Space Gateway



Further - everywhere

The Asteroid belt

Mars

The main stages of the project:

November 2017: 17 days
2018-2019: 4 months
2020-2021: 8 months
2021-2022: 1 year
2023-2024: 1 year
2024-2025: 1 year

«SIRIUS-17 – SIRIUS-19» CREWS

The study was conducted in the framework of the two simulations within the frame of the project "SIRIUS".
These experiments simulated flight to the Moon of an international mixed-gender crew.
The experiment involved 6 volunteers (3 men and 3 women; 28 to 45 years).

NOVEMBER 7-24, 2017
17-DAY EXPERIMENT WITH ISOLATION «SIRIUS-17» WAS SUCCESSFULLY CONDUCTED

MARCH 19 – JULY 17, 2019
4-MONTH ISOLATION EXPERIMENT «SIRIUS-19» WAS SUCCESSFULLY CONDUCTED

CREW ACTIVITIES IN SIRIUS PROJECT

Before Isolation

Crew Selection

Crew Training

BDC

Medical Control

Interviews

Isolation

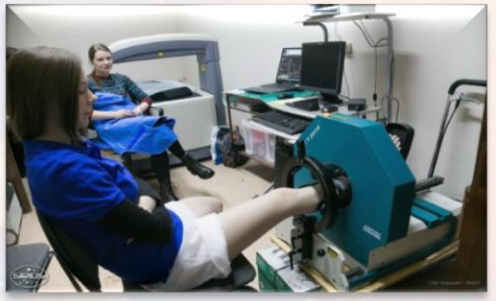
Scientific Experiments

Medical Control

Operational Activities

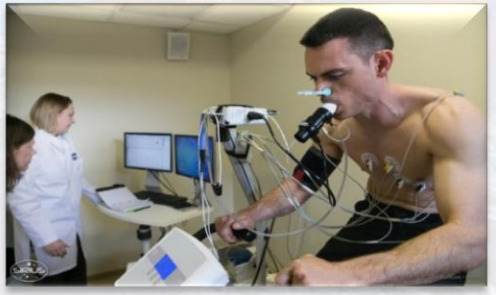
After Isolation

Scientific Experiments



Interviews

Medical Control



PSYCHO-PHYSIOLOGICAL INVESTIGATIONS

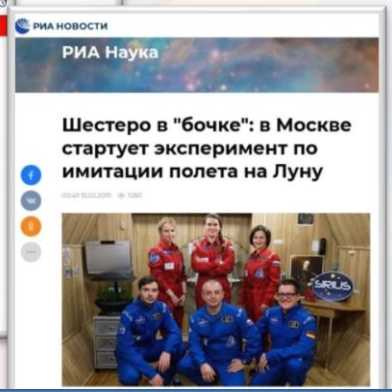
PHYSIOLOGICAL INVESTIGATIONS

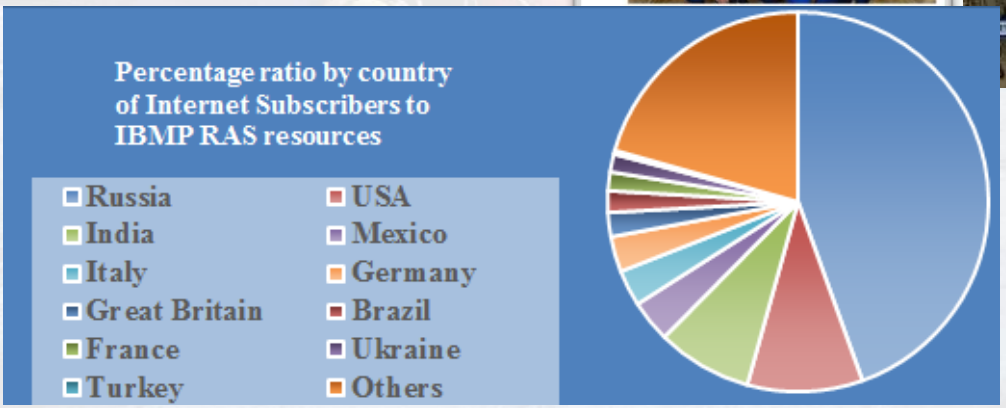
METABOLIC INVESTIGATIONS

MICROBIOLOGICAL AND SANITARY HYGIENIC INVESTIGATIONS

PUBLIC RELATIONS

Interaction with the media and target audience





Number of publications on the SIRIUS project in electronic media for 2016-2019

Publications in RF	More than 450
Foreign sources	More than 60
Videos	52
Radiospots	12

KEY MISSION SCENARIO FEATURES

- 8 Month Isolation
- Gender mixed international Crew
- EVA Activity
- Communication delay
- Resources restriction
- Operational Tasks

STAGES OF THE «SIRIUS-20/21» REALIZATION

• Science program draft	January 20, 2020
• Crew selection	August 12, 2020
• Start crew training, BDC, team building, “Dry Run”	August 13, 2020
• Start of Isolation	November 19, 2020

VOLUNTEER RECRUITMENT NOTICE

Institute of Biomedical Problems of RAS
7 ноября в 16:07 ·

The State Scientific Center - Institute of Biomedical Problems (IBMP) of the Russian Academy of Sciences has begun preparations for the third stage of the model isolation project “SIRIUS” (Scientific... Ещё

NASA's Johnson Space Center
среда в 17:46 ·

Ever dreamed of what it's like on a long-duration space mission? Are you in a STEM career & speak English & Russian? You may be eligible for an 8-month analog mission in Moscow, Russia to study isolation & confinement for future **#Artemis** & Mars missions: nasa.gov/analogs/nek/participate

OUR PARTNERS

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МУЗЕЙ КОСМОНАВТИКИ
ПРОСПЕКТ

INTERNATIONAL PARTICIPANTS

THANK YOU
FOR YOUR ATTENTION!