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BIOLOGICAL SATELLITE "KOSMOS-936"

L. A. Vedeshin

2. Government Accession No.  
   NASA TM 75097  
3. Recipient's Catalog No.  

4. Title and Subtitle  
   Biological Satellite "Kosmos-936"  

5. Report Date  
   April, 1978  
6. Performing Organization Code  

7. Author(s)  
   L. A. Vedeshin  


9. Performing Organization Name and Address  
   SCITRAN  
   Box 5456  
   Santa Barbara, CA 93108  

10. Work Unit No.  

11. Contract or Grant No.  
   NASW-2791  

12. Sponsoring Agency Name and Address  
   National Aeronautics and Space Administration  
   Washington, D.C. 20546  

13. Type of Report and Period Covered  
   Translation  

15. Supplementary Notes  
   Translation of "Biologicheskiy sputnik 'Kosmos-936'", Priroda  
   No. 11, November, 1977, pp. 147-148.  

16. Abstract  
   A description is given of physiological experiments performed on the  
   biological satellite Kosmos-936. Other experiments to determine the  
   electrostatic and dielectric responses to the effects of cosmic radiation  
   are discussed.  

17. Key Words (Selected by Author(s))  
18. Distribution Statement  
   Unclassified - Unlimited  

19. Security Classif. (of this report)  
   Unclassified  
20. Security Classif. (of this page)  
   Unclassified  
21. No. of Pages  
   6  
22.  

NASA-110
BIOLOGICAL SATELLITE "KOSMOS-936"

L. A. Vedeshin

On August 3, the Soviet Union launched the artificial satellite Kosmos 936. It carried biological material and scientific equipment of four countries: the U.S.S.R., Czechoslovakia, U.S.A., and France. The satellite was injected into an orbit with the following parameters: initial period of rotation - 90.7 minutes; apogee - 419 km; perigee - 224 km; orbital inclination - 62.8°.

Very diverse experiments were included in the flight program of the new biosatellite; physiological, radio-biological, and engineering - physical experiments. The basic purpose of these experiments was to further investigate the influence of weightlessness on living organisms; to establish the biological effects of the artificial force of gravity; and to study radiation safety in long-term space flights.

The physiological experiments performed in the space laboratory used albino rats, which were bred by Bratislavan biologists (Institute of Experimental Endocrinology, Slovak Academy of Sciences) under special conditions in a bacteria-free environment. Each rat was able to move freely inside individual small compartments, equipped with a life support system. Each compartment contained feeding bowls, drinking fountains, illumination, ventilation, and special devices for feeding and waste removal.

The condition and behavior of the experimental animals during the flight were evaluated by means of an electronic control system, which transformed their movements into electric signals which were then transmitted to the earth. Some of the animals carried implanted miniature radio temperature sensors.

Some of the compartments with the rats were located on a rotating

*Numbers in margin indicate pagination in foreign text.*
platform - a centrifuge - which produced artificial gravity equal to that of the earth. The other portion of the experimental animals was in a state of weightlessness. Since all other flight factors were identical for both groups, both during the experiment and after the results were processed, this made it possible to compare the processes taking place under weightlessness and under conditions of artificial gravity. The purpose of the physiological experiments was to investigate the mechanisms for subjecting different systems of the organisms to the effects of prolonged weightlessness, and also the re-adaptation to the force of gravity on the earth after the flight. The results obtained were used by specialists to evaluate the functional reserves of the most important systems producing adaptation reactions. The greatest attention was given to a detailed study of the support and locomotor systems, primarily the bones. The experiment provided new data about the effectiveness of artificial gravity as a prophylactic measure under the unfavorable influence of weightlessness.

Figure: Scientific Equipment and Mockup of the Kosmos 936 Biosatellite
The experiment studying the influence of weightlessness on the aging of insects was carried out together with specialists from the Institute of Medical-Biological Problems of the U.S.S.R. Ministry of Public Health, and the Ames Research Center of the National Aeronautics and Space Administration, U.S.A. Drosophila of the Oregon line was used for the experiments. These studies provided information about the rate of vital processes of living organisms. A Soviet-French radiobiological experiment investigated the biological actions of heavy nuclei of galactic cosmic radiation. By means of this experiment, the scientists expected to obtain a detailed picture of the biological action of heavy nuclei on unicellular organisms and plant seeds. Soviet specialists performed several biological experiments with lower and higher plants. Under conditions of weightlessness, the culture chambers contained corn sprouts, crepis, and lower fungi. The purpose of these experiments was to investigate the role of gravity in the formation of cellular structures, and to trace the genetic variations of plant cells at different stages of development. Equipment developed and manufactured in Czechoslovakia (Safarik University) was used to perform the experiment Teploobmen-1 to determine the influence of weightlessness on the physical processes of heat exchange between a heated surface and a surrounding air medium.

Kosmos 936 also performed tests of a system for electrostatic and dielectric protection of equipment, and the action of radiation. This experiment was based on the properties of an electric field to deflect fluxes of charged particles. This field was produced without a high-voltage generator, using a special electronic device on the outside shell of the satellites producing electron fluxes. This simulated the operation of the protection system in an autonomous mode when the satellite passes through radiation belts of the earth. A synchronous control experiment using a mock-up was initiated on the earth after the launch of the biosatellite. This mockup also contained groups of biological materials such as were on Kosmos 936. The following flight conditions were maintained on the earth, with the exclusion of weightlessness: temperature, humidity, composition of the atmosphere, etc. A comparison of the results of the flight and earth-based experiments made it possible to separate the influence of space flight factors. Several large scientific centers took part in the processing of the materials obtained during the flight. These centers were the Institute of Biomedical Problems
of the U.S.S.R. Public Health Ministry, the Bakh Institute of Biochemistry, and other Soviet scientific institutes, the Joliot-Curie Institute of Radiology in Budapest, the Institute of Aviation Medicine in Warsaw, the Institute of Normal and Pathological Physiology in Bucharest, the Safarik University in Kosice, the Pasteur Institute in Paris.
Космические исследования

Биологический спутник «Космос-936»

3 августа в Советском Союзе был произведен запуск очередного искусственного спутника Земли «Космос-936». На его борту размещались биологические объекты и научная аппаратура четырех стран — СССР, ЧССР, США и Франции. Спутник выведен на орбиту с параметрами: начальный период обращения — 90,7 мин; расстояние от поверхности Земли в апогее — 419 км, в перигее — 224 км; наклонение орбиты — 62,8 град.

В программе полета нового биоспутника — самое разнообразие экспериментов: физиологические, радиобиологические, инженерно-физические. Основные задачи этих экспериментов — дальнейшее изучение влияния невесомости на живые организмы; оценка биологических эффектов искусственной силы тяжести; исследования по радиационной безопасности при длительных космических полетах.

В физиологических экспериментах на борту космической лаборатории использовались белые крысы, выращенные на биологическом биопробе (институт экспериментальной эндокринологии Ленинградской академии наук) в специальных условиях и лишенные патогенных бактерий. Каждая крыса находилась в свободном состоянии в отдельном небольшом отсеке, оборудованном системой жизнеобеспечения. Внутри отсека имеются корышки, понож, освещение, отверстия для вентиляции и специальное устройство для сбора и удаления отходов жизнедеятельности.

Состояние и поведение подопытных животных в полете оценивалось с помощью электронной системы бесконтактного контроля, которая преобразует их движения в электрические сигналы, поступающие на Землю. Некоторым животным были введены миниатюрные радиодатчики температуры тела.

Несколько отсеков с крышами размещались на врачающемся платформе — центрифуге, которая создает искусственную силу тяжести, равную земной. Другая часть подопытных крыс находилась в условиях невесомости. Поскольку все прочие факторы полета для обеих групп животных одинаковы, это позволяет как во время эксперимента, так и после обработки результатов сравнить в чистом виде процесс, протекающий в невесомости и в условиях искусственной гравитации.

Физиологические эксперименты направлены на исследование механизмов приспособления различных систем организма к воздействию длительной невесомости, а также...