SPACE RADIATION'S IMPACT ON THE HEALTH OF ASTRONAUT AND METHODS OF PROTECTION FROM IT

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ВЛИЯНИЕ КОСМИЧЕСКОЙ РАДИАЦИИ НА ЗДОРОВЬЕ КОСМОНАВТОВ И МЕТОДЫ ЗАЩИТЫ ОТ НЕЕ

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In this article, space radiation's impact on the health of astronauts was considered. The materials of study were Russian and foreign works about measuring methods of space radiation on International Space Station (ISS). The available way of ISS's space radiation protection.

В данной статье рассмотрено влияние космической погоды на здоровье астронавтов. Проведен анализ зарубежной и отечественно литературы об имеющихся данных о способах мониторинга дозы космической радиации на Международной космической станции(МКС). Изучены имеющиеся способы защиты космических станций от радиации.

The presence of radiation in space creates a lot of problems, such as issue for designers of spacecraft and also astronauts, which flying on the space stations and spaceships. Before the first human's space flight, radiation safety issues were carefully studied. According to the source [1], determination of the space radiation dose experiments were explored. As it turned out, that orbits with altitude of 300-400 km radiation dose is relatively small(it was on such orbits manned spacecraft is flying). According to devices installed inside the space station "Mir", the space radiation doses are varied within wide limits: from 100 to 800 μGy per day. That is permissible value for the human, but it is more than it receives the staff of nuclear power plants under normal conditions. [1]

These factors of space weather can be described as "arresting" because of that have a direct negative impact on human health and equipment operability in the space. Higher doses of corpuscular radiation created:

- Radiation danger for astronauts;
- Problems of spacecraft working and radio communication, associated with their surface and volume electrification and also destruction of important electronic components;
- degradation of solar cells and structures of satellites;
- Problems with optical satellite system, and as a result- disruption and disorientation. [2]

Extra danger for spacecraft and astronauts in near-Earth orbits is corpuscular radiation, and the sources of that are:

- Galactic space rays;
- Solar space rays from the active phenomena on the Sun;
- The interior and external radiation zone of Earth;
- Ionizing electromagnetic radiation.

Nowadays question about astronauts' protection from Space weather is international problem. That is why, at the present time, goals of 47 ISS's crew are the researching of the effect of space on human health. One of the goals is to determine the exposure dose inside ISS with using various devices. Researches focus on identify the negative impact of long-term missions on the crew's health, that is extremely important for the preparation of travel to Mars. For astronauts it means the process of survival in potentially hazardous space conditions.

For determining of radiation impact new scientific installation DOSIS-3D (Figure 1) is used, that combines various radiation detection devices. The device gives opportunity to obtain data about irradiation in real time.

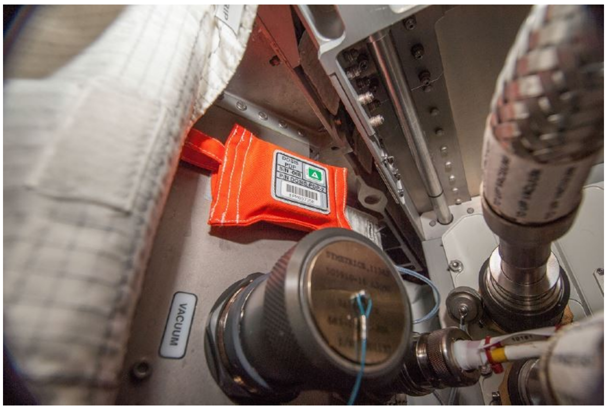

Fig. 1. Scientific installation for radiation control DOSIS-3D

DOSIS-3D uses multiple active and passive detectors to determine the dose of radiation inside the station. Purpose of that device is to create a three-dimensional map of radiation, covering all sections of the ISS, and to determine the distribution of radiation levels on board. Except for DOSIS-3D for radiation detection on ISS also the Tissue Equivalent Proportional Counter (TEPC), the Charged Particle Directional Spectrometer (CPDS), the Radiation Area Monitor (RAM), and the Crew Passive Dosimeter (CPD) are used. [3].

Using the device for radiation control gives possibility to determine dependence of radiation dose from the ISS location. In this way, Polar Regions with open magnetic field lines, anomalies of the geomagnetic field in the form of the Brazilian magnetic anomaly were determined (Figure 2). [4] In this area, the internal radiation belt is the most closely approaches to Earth's surface. Satellites are affected from the spurs of radiation belt by Brazilian magnetic anomaly just in air area of that anomaly.

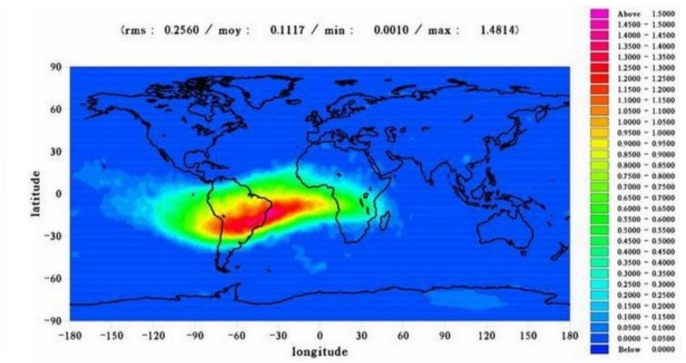

Fig. 2. Brazilian magnetic anomaly

Earth has own magnetic field, and because of that, Earth is provided from the outer space radiation protection. Life on the Earth without a protective magnetic field is not possible. The spacecraft with astronauts on board will be forced to leave the area of the magnetic protection of our planet by doing of interplanetary travel. As shown by recent research, in the process of the flight to Mars, astronauts can receive a dose of radiation from the action of space radiation in excess of 3-4 times limiting of the human exposure extent. [5]

One of the ways to protect astronauts from radiation is to create own electrostatic field by spacecraft. Inhabited compartment, that is house for astronauts, has a spherical shape. That surface has negative electric charge.As it is known, the electric field is absent inside the charged surface. It means that the charged inside inhabited compartment is also absent. At a certain distance from the charge surface of the inhabited compartment has another spherical surface, and the charge is positive. To reduce in 4 times the level of radiation exposure to astronauts, it’s necessary to ensure the protection of the inhabited compartment from the charged particles with a maximum energy. And the energy should be just about 10 GeV. Electrostatic protection is the process of braking and reflection of charged by the surface (Figure 3). [6]

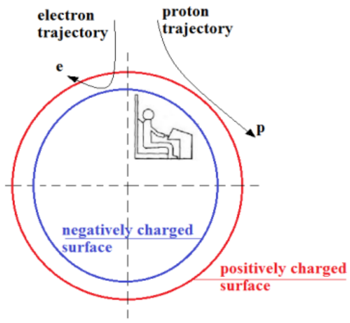

Fig. 3. Model of spacecraft electrostatic protection from radiation

Conclusion. Currently, research about monitoring of radiation inside the International Space Station is leaded. Meanwhile, the technologies that give opportunity to increase the radiation resistance of spacecraft is extremely little. To implement a long-term mission on the space orbit, we need to develop a program of activities that allow to solve this problem. Subsequently, it is necessary to get an analysis of domestic and foreign literature by the topic of interest, for the purpose of systematization and publication of radiation protection unified system for the spacecraft.

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