

conditions the RSRPE along with the reception of retransmitted signals from a retransmitter in the frequency range of NSC signal relaying receives in the standard frequency range. Cooperative processing of the measurement results of NSC signal received on the object and retransmitted through the repeater makes it possible to realize high-precision determination of the relative

coordinates of the object relating to the RSRPE. In such conditions realization is possible for mobile objects both code and phase mode to determine relative coordinates. Phase mode realization is possible, due to the fact that in the RSRPE there is complete information about the frequency-timeline of an object by using a pilot signal.

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I. A. Maximov

JSC "Academician M. F. Reshetnev" Information Satellite Systems", Russia, Zheleznogorsk

PROBLEMS OF SUPPORT OF MODERN SPACE CRAFT RELIABLE FUNCTIONING UNDER THE CONDITIONS OF THE DESTABILIZING INFLUENCE OF SPACE AND ANTHROPOGENIC FACTORS

The statistic analysis results of cases correlation of abnormal functioning of SC with increased levels of geomagnetic activity are represented in the article. The main results of completing work package in JSC "ISS" to research negative influence of space environment on SC, and the main results of the development of the protective means and methods are described in the article.

Keywords: space craft, SC (space craft) operation, space factors, anthropogenic factors and protective means.

The main operating characteristic of any satellite system is durability that is the ability to perform the specific tasks by all included space craft (SC) during the required life time.

The modern SC includes hundreds of radio-electronic blocks, optical devices and operating surfaces, thousands of structure elements and cable assemblies. This technical complex must operate during all life time (up to 15 years) under the conditions of negative space environment influence.

In the process of full – scale operation the SC is subjected to the influence of the wide spectrum of space factors (SF) and anthropogenic factors (AF). The results analysis of domestic and foreign SC operation indicates the presence of SC abnormal operation correlation of significant degree with variations of solar activity, space geomagnetic disturbance and anthropogenic conditions of SC operation.

According to the conclusion of the Federal Space Agency and Space Forces "...One of the main factors affecting on the characteristics stability and reliability of on-board radio – electronic equipment is space ionizing radiation.

Reportedly, there is 30–50 % of on – board radio – electronic equipment failures per the part of these effects" [1], and "the support of required stability is the most important task of SC manufacture with the long life time (10–15 years), contemplated by the Federal space program of Russia" [2].

Researches conducted by NASA and USAF also indicated, that up to 1/3 of failures at foreign SC

operation have operational character and stipulated by the geophysical factors.

During researches the readable dependence between the level of geomagnetic activity and the rate of SC failure of different missions was detected.

It is determined the number of failures of SC on – board equipment rises several times due to solar activity increase [3].

The data analysis on anomalies in the operation of the domestic SC conducted by the specialists of 4 RF CSRI of Ministry of Defense, indicated that general number of failures of on – board SC systems, exchange dysfunction of the control and target information during high heliogeophysical activity increases 2–2,5 times, that, in its turn, sharply shortens the mean time of their active functioning. More than 50 % (on some systems up to 90 %) of them occur because of environment external action on SC on – board equipment. More than 80 % of such failure influences somehow on the performance of specific tasks [3].

At present all these problems are becoming more actual due to transition to the non-pressurized SC performance. The transition to such SC structure is caused by necessity of Life time increase up to 15 years and also by the increase of power supply capacity of newly developed SC. But at the same time the new mechanisms of the space environment influence on-board SC systems appear. All these influences without special analysis and necessary protective means can lead to the serious failures of on-board systems of the modern domestic SC.

Considerable effect on SC operability can also be produced by anthropogenic factors. So during the

operation of stationary plasma thrusters (SPT) the number of anomalies in the operation of on-board systems was fixed. First of all it was connected to intensive interaction of SPT jet with the surface, proper outer atmosphere and high voltage SC equipment. Besides, SPT operation can generate optical interferences, influence radio signals transceiving, generate interferences in the control and power circuits, cause thermal, force, contaminating, erosive effect on the SC elements, influence the intensity and amplitude of the charge – discharge processes on the SC structure elements and interference situation on SC board.

It is obvious that the range of destabilizing factors influencing SC in the process of orbital operation is very wide. Therefore one of the main problems in the applied cosmophysics at the SC manufacture and reliable operation support is the problem of resistance to the space factors influence and anthropogenic factors.

To solve the problem, JSC “ISS” performed the work package to research SF and AF levels and influence mechanisms on SC on – board systems, influence modeling, followed by development of the protective methods and means and also production of SC resistance control and diagnostics system, used in the process of ground tests and SC full – scale operation.

At present the following main results were obtained:

1. Influence mechanism of SF и AF on SC was revealed, though earlier it had not been taken into account at SC manufacture and full – scale operation:

- quasi-static potential difference, induced between power buses and SC body;
- development of the discharge processes in the result of SPT plasma influence on the high voltage SC equipment.

2. The indicated mechanisms influence on SC were manufactured and on their base there were necessary protective means and methods developed, which can provide the reliable functioning of the modern domestic SC.

3. In bench tests the effectiveness of filters, developed for the protection against potentials quasi – static difference between power buses and SC body, was checked.

4. The complex of experimental researches on determination of appearance and development criteria of the discharge processes in high voltage equipment in the condition of SPT plasma influence was performed.

5. The full – scale experiments were prepared and conducted, they permit:

- to estimate the influence level on SC charge of artificial plasma formations;
- to confirm the effectiveness of the developed protective means from the induction between power buses and SC body of potentials quasi – static difference, occurred in the result of differential charge of SC structure elements;
- to determine the plasma parameters of the nominal SPT in the places of on – board equipment and also to estimate the degree of SPT plasma influence on SC structure charge.

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