the NAS of Ukraine (Fig. 2). This kind of instrumentation has been used in experiments onboard the «Kosmos-1643» and «Kosmos-2007» satellites. An integrated laboratory study of the following parameters should be performed before setting up the proposed experiment in the URM:

— response angle coefficients of space-borne instrumentation at interaction with a running gaseous flow with the energy of 7-17 eV against the background of intensive UV radiation; calibration of instrumentation;

— parameters of outgassing of a full-scale model of a spherical shell (r = 0.3 ... 0.4 m) made of a porous material;

— parameters of the atmosphere both inside of a spherical shell volume and in its vicinity for the rate of the flow levels of the known gases (Ne, Ar, Kr, Xe, etc.);

— parameters of permeability of a spherical shell and evaluation of stability of these parameters.

The dynamic calibration of instrumentation will be completed using the supersonic Vacuum Aerodynamic Plant (VAP-2M) and a cryogenic pumping down system. The VAP-2M belongs to the Institute of Technical Mechanics of the NAS and NSA of Ukraine.

References

1. Abramovskaya M. G., Bass V. P., Petrov O. V. Definition of integral cross-sections for scattering atoms and molecules. — Patent N 1584583, 04/28/1990.
2. Bass V. P. Gas-dynamic aspects of formation of the external atmosphere of spacecraft moving in the Earth upper atmosphere // EAS observations. — M.: Astrosovet AS USSR, 1986.—N 24. (in Russian).
3. Bass V. P. // Tech. Mechanics.—1999.—1.
4. Bass V. P., Brazinsky V. I. // Zh. Vych. Mat. & Mat. Fiz.—1988.—28, N 7.
5. Bass V. P., Brazinsky V. I., Zabluda S. M., Fridlender O. G. // Tech. Mechanics.—1998.—8.

«Diagnostics» Experiment

DIAGNOSTICS, MONITORING, AND STUDY OF A SET OF PARAMETERS OF THE IONOSPHERIC PLASMA AND ENVIRONMENT NEAR THE ISS

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The ionospheric plasma is highly sensitive to the influence of external sources of solar, space, technogenic, and anthropogenic origin. The ionosphere responds to the solar and seismic activity, cyclones, magnetic storms, power explosions, volcanic activity, pollution of the troposphere, as well as active experiments during launches and flights of rockets and satellites. This is manifested as the periodical and non-periodical fluctuations of the main kinetic parameters of the ionospheric plasma, namely concentration of charged and neutral particles, pressure and degree of ionization, temperature of charged and neutral particles, electric and magnetic field strengths, energy spectrum of charged components, plasma potential.

The purpose of the experiment is to monitor and to study the ionospheric plasma by the contact methods for solving the inverse task, namely, to localize the sources of natural cataclysms by identifying the fluctuations of the main plasma kinetic parameters. We are also planning to develop methods and models of ecological and anthropogenic monitoring and forecasting.

The considered problem has two components. The first one is connected with implementation of the direct contact plasma diagnostics in the F_2-region of the ionosphere. The second component is connected with such items as interpretation of the measurement results, establishment of interconnection of periodic and non-periodic fluctuations of the ionospheric plasma parameters with spatial-temporal localization of the sources of external effects, as well as identifying their characteristic features and origin. The spatial-temporal synchronism of the external influence, event, and measurement can be ensured only in a manned spacecraft.

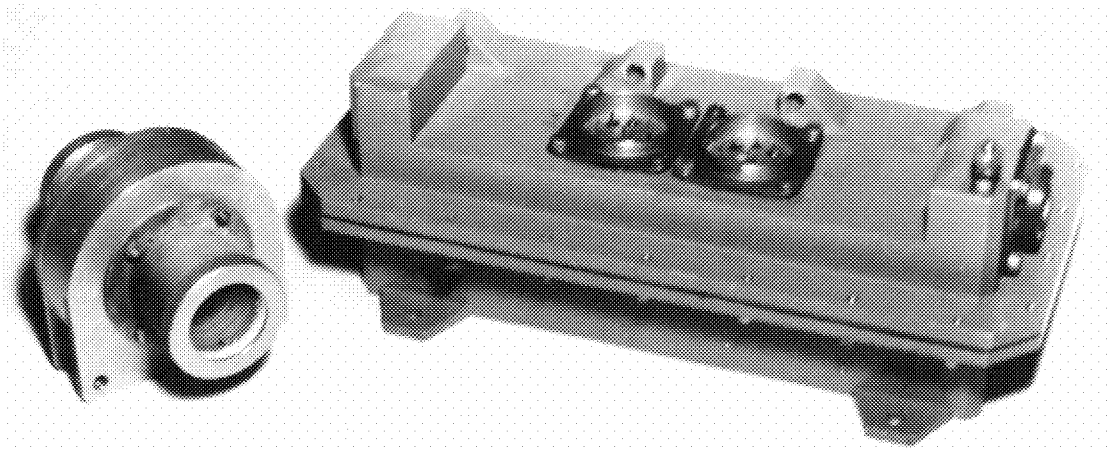

Fig. 3. «BMC» unit (sensor is shown on the left; modules for control, analysis, and processing of the data are on the right)

The experiment proposed will be realized with application of the new «BMC» unit (block for measurement and control). The operating characteristics of this unit are the best suitable to measure the above parameters of low-density ionospheric plasma in a wide range. The «BMC» combines the properties of the inverse-magnetron converter of the transit type and two multi-electrode probe energy-analyzers (ion and electron). The «BMC» unit consists of the sensor, modules for control, analysis, and processing of the data (see Fig. 3). The sensor dimensions are $D = 0.08$ m, $L = 0.1$ m, and its mass is equal to $M = = 0.8$ Kg. The experiment will be completed with the use of two sensors. They are installed on the boom of a modifiable length, which provides two fixed positions (at the distance $l_1 = = 1.0$ m and $l_2 = 10 \ldots 15$ m from the station surface). The parameters of the ISS own external atmosphere are measured in the first position and the parameters of the non-disturbed ionospheric plasma — in the second position. To minimize the influence of ionospheric plasma disturbances, the boom with sensors should be installed on the front (exposed to the «wind») side of the ISS. The symmetry axis of one sensor is oriented along the ISS movement, and the symmetry axis of the other sensor is perpendicular to the velocity vector of the plasma flow. The experiment is practically fully automated. The device offers the advantages of design simplicity, small power consumption, higher reliability, and resistance to the influence of reactive and toxic components.

During 1987-1992 a simplified variant of the unit proposed, namely the inverse-magnetron converter, was operated in the «Kvant» module of the «Mir» station [1]. The ion multi-electrode probe was used in the «Alfa-2» complex on the tail and auroral sondes [2] for measurement of the local parameters and study of the spatial plasma distribution.

References

1. Guzhva E. G., Nikitskii V. P., Shuvalov V. A., et al. Results of the study of the external atmosphere in the vicinity of «Mir» orbital complex // Proc. of the X-th All-Union Conf. «Dynamics of rarefied gases». — M, 1989.—P. 198. (in Russian).
2. Bezrukih V. V., et al. Study of the low-energy plasma in the Earth's magnetosphere with the tail and auroral sondes // Kosmich. Issled.—1998.—**36**, N 1.—P. 33—41. (in Russian).