Fourthly, the experiments proving the connection of the processes in the near space with the tropospheric and stratospheric meteorological processes, and phenomena occurring in the Sun and in the interplanetary medium, as well as on the surface and in depth of the Earth, open a prospect for creation of a self-consistent model — the concept of «space weather», being rapidly developed recently.

The project is aimed at development of a new procedure of global monitoring the near-Earth's plasma using the ISS-mounted HF and VHF receiver complex and applying the method of radio sounding with signals of the ground-based broadcasting and television stations. The tomographic methods are proposed for reconstruction of the ionosphere, which find ever-new applications in various areas of science and engineering. Despite rather detailed algorithms available for tomographic reconstruction of the ionosphere, they cannot be immediately incorporated into the suggested procedure. The point is that the conventional methods for measurement of linear integrals (total electron content (TEC) along the line of sight) imply arrangement of special transmitters onboard the space vehicle, while the transmitted signals are received on the Earth's surface.

Therefore, the experiment considers non-traditional methods for radio-tomographic reconstruction of the ionosphere by using the polarization patterns of the sounding signals. Apart from the tomographic reconstruction of the ionosphere, the intent is to use some other diagnostic capabilities of the said radio sounding procedure. It allows, for example, to fairly easily measure the local value of electron concentration in the space vehicle vicinity.

On-board equipment includes:

— HF and VHF antenna systems based on small-sized orthogonally polarized broadband dipoles;

— multi-range, coherent, program-driven receiver complex supplied with a panoramic scanner and multichannel sub-band recorders;

— fast analog digitizer;

— computing hardware coupled with the systems of data visualization, accumulation and transmission;

— applied software package ready for quick data processing, visualization and analysis onboard the ISS.

The above assumes close interaction with the ground-based diagnostic centers located in the space vehicle's sub-radar point. Application packages for data processing, storage and visualization will be developed on the basis of the built diagnostic algorithms. Computer simulation is suggested for testing and finalizing the method. Alongside with implementation of these items, analysis of a global net of transmitting centers will be done to select the radio sounding frequency, space and time ranges matching the ISS position in orbit. After manufacture of the prototype and flight models of a receiving-measuring complex, the ground observatory-based full-scale measurements will be performed.

The final result of the experiment is to manufacture an on-board unit with the appropriate software. Thus, due to a large number of HF and VHF stations, the suggested procedure of diagnostics will enable practically continuous global monitoring the near-Earth's plasma to be completed.

«Synthesis» Experiment

FEASIBILITY OF MAGNETOHYDRODYNAMIC INTERFEROMETRY IN THE MAGNETOSPHERE

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The transfer of energy and information between different parts of the «magnetosphere — ionosphere» system is largely determined by magnetohydrodynamic (MHD) waves, which are low frequency vibrations ($\omega < \Omega_i$) of the electric and magnetic fields, as well as by charged particle displacements and velocities in the interplanetary and terrestrial plasma. The conditions for MHD wave propagation through the geospace depend essentially on structural features of the magnetosphere and physical processes occurring in the magnetospheric/ionospheric plasma. This suggests a possibility of MHD diagnostics, i. e., determination of the propagation medium parameters from observed variations in

the geomagnetic field. Measurement of the geomagnetic disturbances falling into the class of micropulsations ($\omega \approx 0.01$—5 Hz), allows estimation of the plasma density, energy and location of energetic particles, position of the magnetopause, cross-field conductivities of the lower ionosphere and other parameters of the geospace [1, 2]. The micropulsations can be observed with a variety of techniques, however most of these are indirect methods as long as MHD waves in the plasma are concerned. That is, ground-based observations of the ULF (ultra-low frequency) electric or magnetic field variations actually refer to components of the «secondary» electromagnetic response produced by the lower ionosphere under the impact of an incident MHD wave. The MHD waves proper are observable in or above the ionosphere, either with HF/VHF radars or satellite-borne magnetometers [3, 4]. Spatial characteristics of the magnetospheric pulsation signatures (localization near a certain magnetic shell, cross-phases for a few observation points, state of polarization and angular spectrum) can be studied only through multiple point measurements. (The ESA Project Cluster [5] envisaged direct simultaneous observations of geomagnetic field components at a few points in the magnetosphere with provisions for the temporal and spatial resolution, which enabled calling the facility a «wave telescope»). A MHD wave telescope implements the idea of spaced or interferometric reception at pairs of observation points. If an ensemble of such pairs is available, where the baselines differ in length and orientation, it should be possible to restore the amplitude and phase distribution of the wave field and angular spectrum of the signal received. Some of the baselines might not be real but rather synthesized, based on the orbital motion of the satellite carrier.

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«Reliability» Experiment

INFLUENCE OF LOW-FREQUENCY ATMOSPHERIC ELECTRICAL PROCESSES AND NEAR-SPACE ELECTROMAGNETIC SIGNALS ON THE CENTRAL NERVOUS SYSTEM FUNCTIONAL CONDITION OF A MAN MAINTAINING SPACE SYSTEMS

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The natural low-frequency radiation corresponds to «a noise» initiating thunderstorm activity, Earth's emissions, etc. The noise spectrum always possesses the frequencies (8, 14, 20 and 26 Hz), which are attributed to the «Earth-ionosphere» resonance system. Thus, the man on Earth permanently exists in a species of resonator. There is no resonator influence in near space, as no resonances are observed