

A Remote Upgrading of a Space-Borne Instrument

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An intelligent instrument – Cylindrical Langmuir Probe – has been devised for the International Space Station. The main goal of the project is the investigation of the interaction of a super-big body with the surrounding plasma. To this end the electromagnetic and plasma parameters will be measured in the vicinity of the station. The communication between the station and the Earth will be realized through the telemetry information channels based on radio-frequency connection. Apart from scientific data from the instruments, these channels will be also used for transmitting of commands from the Earth (about the instruments' modes of operation), as well as information blocks (containing object code) for changing the processing and control programs of the various instruments of the complex. The principles of devising specialized software are described providing the change of the program modules of the Langmuir Probe by ground-based commands in order to maintain the scientific experiments in real time. Each scientific program is realized as a state machine and is controlled in real time by its state variables and by the values of the measured parameters. On the basis of the measurements it calculates scientific data and saves them as 8-byte elements in 512 K external memory. It is activated by a command from the Data Acquisition and Control Unit or it is active by default at the initialization. The program realizes one out of four possible tasks (scientific experiments) and takes up a 16 K section of the microprocessor's address space. Using the communication channel between the control unit and the instrument, a specialized protocol is realized permitting the change of the program code of a given section by another one. This change does not require the operation of the other experiments to be terminated.