NEW MODELS AND TOOLS FOR SIMULATING THERMAL PROCESSES WHILE TESTING ONBOARD EARTH REMOTE SENSING INSTRUMENTS

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The poster report deals with a ground testing of satellite Earth Remote Sensing (ERS) instruments, housed both inside spacecraft (SC) unpressurized compartments and outside SC, in outer space. SC thermostatically controlled thermal boards (TTP) usually serve as a sink for dissipated thermal energy.

One of the main features of the satellite equipment for the ERS is the intermittent nature of its functionality: short switch-on lasting for (600÷1200) seconds followed by long pauses between communication sessions. Heat-loaded transmit/receive equipment is characterized by huge power dissipation. In many cases, to provide the desired thermal conditions for electronic components, certain blocks are equipped with heat accumulators (HA) of passive type, in which endothermic effects of phase changes inside shape-stable composite materials are realized. The HAs don't require the use of electrical and mechanical devices to resume their repeated operation. At the same time, weightlessness practically does not affect the thermophysical parameters of the HAs. Various types of heat pipes (HP) are widely used to transport dissipated heat energy to the SC heat sinks. Their orientation in respect to gravity has been taken into account while testing.

The introduction of new methods for adequately simulating the environmental conditions of outer space under which satellite instruments operate in space is due to the fact that debugging of small-sized instruments inside large thermal-vacuum chambers, usually at spacecraft developers', is quite an expensive solution, increasing costs and development time, particularly in the case of finishing antenna units, mounted outside the SC**.** The novelty of the presented models for simulating thermal processes needed for finishing ERS instruments lies in application of low-cost thermal test facilities in accordance with the technical requirements for designing on-board satellite equipment, inside the small-size thermal vacuum chambers (TVC). At the same time, it's possible to perform final debugging of the on-board instruments at the manufacturer's plant with their subsequent transfer to the spacecraft designers for conducting final comprehensive set of acceptance tests.

Several multi-purpose simulation stands for small-size cylindrical TVCs, having an working volume mainly of no more than 1-2 m^3 and low pressure of 1.33×10^-4 Pa have been built at our institute. The type test stand comprises the small-sized TVC with a cryogenic screen and additional removable screen mounted coaxially with it. The latter is made of the material with high thermal conductivity and its inner outer surface is covered with a coating with a maximum degree of blackness. There is a fixture (in a form of simulator for SC thermal board) designed to install the instrument inside a volume limited by the additional screen. Heaters with power regulation are evenly mounted between the screens inside the circular cavity. Infrared heaters may be installed in the TVC face end. The technical result is in enhancing the types of thermal testing, reducing labor intensity and duration of testing, saving liquid nitrogen needed to cool the cryogenic screen.

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