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Some Aspects of Acoustic Emissions during the Launch of a Space Rocket in Research of Earth by Satellites

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Acoustic fields of various types of radiation and power arise during the rocket's movement in the atmosphere after the launch. One of the most topical studies here is the analysis and assessment of the infrasonic radiation levels and their impact on the health of the nearby settlements population and the spaceport maintenance personnel. Therefore, it is necessary to identify the features and determine the directions of acoustic radiation research based on existing ideas about the generation, propagation, and impact of infrasound.

The methodology for researching acoustic radiation during rocket movement includes identifying the primary sources of acoustic vibrations. That is vibrations from a working propulsion system, from the vibrating shell of the rocket case, turbulent vortices in the flow around the rocket case. And also the identification of acoustic vibrations secondary sources arising from the primary vibrations reflection from collisions with obstacles, for example, the launch pad surface type.

It is necessary to develop physical models of acoustic fields, the nature of which depends primarily on the type of acoustic sources.

These are the following models:

- point radiation (monopoles);
- analysis of acoustic fields generated in the environment by force acting on a rigid surface and characterized by the Lamb potential;
- acoustic radiation and fields during vibrations of plates and shells of various shapes, lengths, and areas;
- acoustic radiation during the movable environment and solid bodies interaction;
- acoustic radiation at the jets outflow from nozzles;
- excitation and propagation of acoustic vibrations inside gas and liquid cavities, taking into

- account the peculiarities of the shells' structural schemes, the resonances identification;
- monochromatic and pulsed radiation.

The next step is the creation of mathematical models designed to calculate the acoustic field characteristics (analytical methods, the use of Taylor and Fourier series, numerical programming methods). Mathematical dependences will make it possible to analyze the relationship between the acoustic radiation sources energy characteristics and the characteristics of their acoustic fields. It is important to calculate the acoustic radiation amplitude-frequency characteristics.

Experimental tests, the development of programs, and methods for measuring the acoustic vibration characteristics are important. At the same time, a list of equipment necessary for measuring acoustic characteristics (instruments, circuits, equipment) is created.

As a result of physical and mathematical analysis of acoustic vibrations sources, it is possible to develop active and passive methods of damping them. As well as giving recommendations for damping acoustic vibrations.