

SPACE PROPULSION SYMPOSIUM (C4)

Propulsion System (1) (1)

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SYSTEM ANALYSIS AND APPLIED STUDY IN THE FIELD OF A CHOICE OF ROCKET ENGINES
FOR PERSPECTIVE REUSABLE LAUNCHERS.

Abstract

The paper describes latest results of the most recent activities in Russia in the technical assessment of perspective reusable launchers. Principal issues of optimum choice of engines for future reusable launchers are considered. Assessment criterion (multiplicity, requirements and specifications for propellant, reliability, safety and etc) are being analyzed. Requirements to the liquid rocket engine (LRE) resource of the perspective reusable rocket space systems (RRSS) on the average much exceed the indicators which have been almost reached by disposable expendable LRE now. Aviation and general-machine-building experience of manufacturing and high-quality production of a space elements is known. The main objective - providing necessary stocks on ultimate loads and durability. The actual resource of many details is limited by one or set of several mechanisms of accumulation of damages. Besides, it is necessary to consider additional factors of a fault probability: corrosion, wear, creep and long durability, small and multi-cycle fatigue. For an assessment of each of the specified factors the criteria of durability and respectively the strength characteristics determined by results of the corresponding tests of samples are inherent. Analysis of experience of LRE SSME land experimental working off and exploitation state in article. The main approaches and recommendations for perspective reusable LRE for RRSS taking into account attraction of approaches to working off of aviation engines are stated. The paper will also give an overview and first results of system analysis and apply study for liquid rocket engines for reusable launcher systems. The expediency of application of methane fuel for impellent installations of first step (launcher with reusable fist stage) is shown. The technique of complex research of durability is given in article on the example of a wall of a tubular nozzle of RLE at reusable start. The fire wall works in plastic area, thus in the course of cyclic loading development enough big unilateral deformations is possible. In the analysis deformation criteria of durability, as the most suitable for research of low-cyclic fatigue durability and crack resistance of a hot wall of a tubular nozzle in the conditions of influence of high temperatures are widely used. Operability of a technique on the example of the analysis of a concrete design is shown.