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DEVELOPMENT OF A LIFTING BODY SPACE VEHICLE, DESIGNED FOR THE RETURN OF CARGO AND CREW AFTER THE LUNAR EXPEDITION.

Abstract

Construction of reusable space vehicle should be design for several launches and landings, it requires additional calculation and testing, compels to apply expensive design and technological solutions. All of this, raise cost of development and manufacturing of reusable spacecraft in comparison with similar only ones usable spacecraft. However, if repeated launch of reusable spacecraft is cheaper than manufacturing of new similar single-use spacecraft, then beginning with certain number of launch, the reusable spacecraft will become more advantageous.

For application reusable space vehicle which return after lunar expedition it is necessary to apply special heat-protective coating. In this paper, two-layer heat-protective coating option is reviewed. External layer is pyrolytic graphite material, internal layer- thermal insulation material based on silica fiber. Pyrolytic graphite has a significantly higher thermal conductivity coefficient in tangential direction to the surface of coating, compared to the coefficient in the direction normal to the surface. This allows redistribution heat from most thermal loaded region to less thermal loaded region, this advance decrease of temperature in most thermal loaded points. Herewith, less thermal conductivity coefficient of pyrolytic graphite in normal direction and presence of the thermal insulation layer limits heating-up of heat-protective coating, construction and internal volume of vehicle. To reduce the intensity of the thermal impact, the return variant of the descent vehicle along a trajectory with multiple entry into the atmosphere is considered.

Purpose of the work is to analyze the effectiveness of using a two-layer heat-protective coating on the "lifting body" space vehicle for return after the lunar expedition. Geometry shapes, layout diagram, aerodynamics characteristic of space vehicle and return to Earth trajectory selecting tasks were set and solved. The problem of space vehicle design construction was solved. Non-stationary computing of sphere nose heating heat-protective coating was done by elemental balance method. Thickness of every heat-protective coating layer was selected to provide the required thermal regime. Total vehicle surface heating was calculated by CFD-analysis. Heat-protective construction and fastening element was developed.