Paper ID: 56600
oral
student

IAF SPACE EXPLORATION SYMPOSIUM (A3)
Solar System Exploration including Ocean Worlds (5)

Author: Mrs. Anastasia Kosenkova
Bauman Moscow State Technical University, Russian Federation

Mr. Victor Minenko
Bauman Moscow State Technical University, Russian Federation

INVESTIGATION OF VARIOUS LANDER'S CONFIGURATIONS POSSIBILITIES CAPABLE OF MANEUVERING DESCENT TO THE VENUS SURFACE

Abstract

Currently, along with other projects to resume the exploration of Venus there is a "Venera-D" mission that is being developed by a Russian-American group of engineers and scientists. The lander structure is proposed similar to the landers of "Venera" and "Vega", which have a spherical form and belong to the ballistic type of a lander that are characterized by zero lift-to-drag ratio at hypersonic velocity and don't have the possibility of maneuvering during descent. The use of spherical (Soviet) and conical (American) landers at the initial stages of Venus exploration was related to the simplicity and reliability of their structure, as the primary task for the lander was to reach the surface with working equipment. At the same time, nowadays scientists speak about some landing areas that seem the most interesting for studying. In this connection the issue of developing a lander to the Venus surface that have the ability to maneuver during the descent in order to enable wide outreach of landing areas, reach these specified areas and make an accurate landing in a planned area is becoming relevant. And it seems promising to consider using the "lifting body" type of a lander which has a permissible complication of the structure and a lift-to-drag ratio sufficient for solving the existing maneuvering tasks in the Venus atmosphere. This paper proposes different types of landers to be considered for the possibility of making maneuverable descent to the Venus surface, a comparative analysis of these landers has been carried out. The calculation of the aerodynamic characteristics for these landers is done by a numerical method based on the Newton's flow theory at hypersonic velocities. Possible descent trajectories for the "lifting body" type of a lander are considered, including the possibility of making maximum lateral maneuver, a comparison of these trajectories with the descent trajectory of a traditionally used ballistic type of a lander is also made. The main technical characteristics of the proposed lander configurations are high maneuverability, the capability to land in the required area, which seem most promising for exploration, as well as the capability of entering the Venus atmosphere while maintaining better thermal operation modes and reduced overloads compared to landers of the ballistic type. Besides, the use of these landers will expand the range of scientific tasks and research that can be carried out already at the stage of descent in the atmosphere before reaching the planet's surface.