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GRAVITY ASSISTS MANEUVER IN THE PROBLEM OF EXTENSION ACCESSIBLE LANDING AREAS ON THE VENUS SURFACE

Abstract

A significant part of the Venera-D project is to identify accessible landing areas. That is primarily related to satisfying the needs of researchers wishing to have access to the most exciting places on the surface of Venus in terms of geological features. However, the choice of accessible areas on the Venusian surface for research is significantly limited. Primarily, this is due to the accepted level of maximum acceptable overload and, as a consequence, the re-entry angle into the dense layers of the Venusian atmosphere. The other factors reducing accessible landing areas are the low angular velocity of Venus rotation and the capability to flight to Venus within the launch window from Earth. Due to the short duration of the launch window, traditionally taken to be on the order of two weeks from the optimal launch date, ensuring accessibility to every point on the surface of Venus proves to be very difficult. The obtained accessible landing areas within the launch window are relatively small due to the imposed restrictions on the re-entry angle. The easiest way to increase the accessible landing areas may be to extend the launch window by moderately reducing the payload mass. However, such possibilities are strongly restricted, primarily by the value of ΔV.

This study proposes using a different way of choosing and reaching any point on Venus' surface. The launch of a spacecraft to Venus during the launch windows of 2029 to 2034 is considered for this purpose. The constraints for the method are the re-entry angle and the maximum possible overload. The primary basis of the proposed strategy is to use the gravitational field of Venus to move to a resonant orbit to

Venus and due to the expansion of accessible landing areas. With this approach, it is possible to provide access to any point on the surface of Venus, but the time of flight will be increased.

Results of the research showed that the new strategy provides an essential increase in accessible landing areas. Also providing access to any point on Venus surface with a small increasing ΔV for launch from Earth and duration of the flight.