SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
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THE ALTERNATIVE CONCEPT OF USE OF LAUNCH VEHICLES WITH RECOVERABLE WINGED BOOSTERS

Abstract

The new concept of return of winged 1st stage boosters of reusable launch vehicles (RLV) is offered to improve the performance and reliability and reduce ecological implications of expendable boosters impact. The most detailed study of the Russian RLV has been carried out in Khrunichev Center [1], where the boosters landing at the launch site is required.

In this paper the RLV efficiency improvement due to refusal of the last strong requirement is investigated. This concept consideration is caused by evident reduction of the "ineffectual" RLV mass due to:

· The absence of the special engines and fuel for dragging spent boosters to the launch site;

· The aerodynamic thermal and g-loads reduction.

This concept requires solution of following problems:

1) Boosters reentry to alternative airdromes for given orbits inclinations;

2) Booster transportation from alternative airdromes to the launch site.

Solutions of these problems depend on a launch site location. In the paper the efficiency analysis of the suggested concept is carried out for the future Russian cosmodrome "Vostochny" [1]. The first problem is solved for both the current and virtual optimal airdrome networks. Additional airdromes construction expenses are not attributed to the RLV cost only, because the cosmodrome "Vostochny" is a moderate part of the state project of the Far East region development, providing for the transport infrastructure improvement. The second problem solution by the "horizontal" transportation of boosters to the launch site by air, land, or water regular means seems to be easier and more economical than drawing in the space rocket.

The analysis of the suggested concept efficiency is based on the rigorous through optimization of RLV branched trajectories [2]. Thus the SP return problem is distributed optimally between the injection and return branches. In this case the typical optimal RLV injection trajectory has an evident 3D-structure to serve given target orbits and sites for boosters landing. The obtained results confirm the expected advantages of the offered RLV usage concept.

References

1. Kuzin, A.I. and others. Khrunichev state research and production space center's project researches on substantiation of reusable space-rocket system. Aerospace Technology, 2010, 1, pp. 3-12.

2. Filatyev, A.S. and Yanova, O.V. ASTER Program Package for the Thorough Trajectory Optimization, AIAA-2001-4391.