IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Interactive Presentations - IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (IP)

Author: Ms. Ceyda Yarımbatman
Plan-S Satellite and Space Technologies, Türkiye

Dr. Ceyhun Tola
University of Turkish Aeronautical Association, Türkiye

CONSTRUCTION OF A SURROGATE MODEL FOR AERODYNAMIC COEFFICIENTS OF A GENERIC HYPERSONIC MICRO LAUNCHER

Abstract

In recent years, there has been a remarkable surge in launch demand, necessitating faster and more frequent launches with closely scheduled dates. This uptick in demand has underscored the importance of adopting modular, smaller launcher rockets within the new space industry for satellite and specific mission-required spacecraft operators. Similar to rapidly launched rockets and schedules, the demand for faster vehicles capable of operating in the hypersonic region has grown substantially. This trend adds significant value to the new space sector. These trends have not only accelerated access to space but have also opened new avenues for reaching further orbits and undertaking interplanetary missions. Hypersonic launch vehicles play a pivotal role in advancing space exploration due to their unprecedented speed and maneuverability. They promise to revolutionize satellite deployment, enabling quicker access to space and more efficient orbit adjustments. Additionally, their potential for rapid response and high precision makes them invaluable assets for orbital injection and payload exact separation strategies in an increasingly dynamic in-orbit environment. Hypersonic micro launchers hold significant potential for all these missions. During the preliminary design of a hypersonic launch vehicle, estimation of aerodynamic coefficients in a fast and accurate manner is critical. Determining the variation of these coefficients concerning different geometric configurations is important, as they are directly used to perform preliminary flight dynamics simulations. This paper investigates the variation of aerodynamic coefficients with respect to different geometric configurations using the response surface method for a hypersonic micro-launcher cruising at Mach 8. Construction of a response surface requires performing many different analyses. To expedite the process, Missile Datcom is utilized to estimate the aerodynamic coefficients for each geometric configuration. The analysis encompasses the examination of various nose models and body structures to elucidate the most effective design considerations for hypersonic missions.