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17th IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT (D3)
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DEVELOPMENT OF A HYPERSONIC VEHICLE CONFIGURATION COMPENDIUM

Abstract

The present era has been witnessing the need for hypersonic vehicle for affordable space access, wherein the technological preparedness of these vehicles is the challenging feature to overcome. The irony of these vehicles was that compared to the present generation, the hypersonic product development cycle was proactive from the late 1960's till the end of 20th century. Though the timeline required, during that period, to achieve the desired Technological Readiness Level (TRL) ranged from 10 years to a couple of decades, the empirical information available were rich enough for different configuration of vehicle to generate an encyclopedia of its own.

The parametric knowledge available for vehicles like X-43A, Space Shuttle orbiter etc., from hours of wind-tunnel test for validation during conceptual design phase and several scale of flight tests have been documented over years. Still, there is a lack of a design tool to formulate the available data into an empirical interface compendium for different configuration-based point designs. This database can act as a networking channel for the current engineers to overcome the gridlock faced in designing prospective hypersonic vehicles.

This proposed paper provides an insight for the need of a Multi-Disciplinary Approach (MDA) for developing a holistic data compendium of past hypersonic vehicles. The database begins with generating a bibliography wherein the vehicle's mission definition, conceptual design data, preliminary phase data and flight test data are segregated and filtered with respective multidisciplinary domains like trajectory analysis, geometry, weight and balance, aerodynamics, stability and control. This module is tested in the form of case studies for three different configuration of vehicles which are wing-body, all-body and blended body and the data obtained are thereby converted into parametric data sets. The coagulation of different data sets corresponding to the distinctive vehicles are formulated into a dashboard. This dashboard will be a Graphical User Interface or GUI, wherein the user can visualize the empirical information of a specified vehicle. The results obtained can be analyzed to compare the performances of multiple configurations for a given mission definition in-order to generate parametric design continuum guidelines, which acts as decision making tool in terms of configuration selection.