

IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Launch Vehicles in Service or in Development (1)

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LAUNCH VEHICLE PROJECT BASED ON BRAZILIAN SOUNDING ROCKETS

Abstract

With the advent of New Space in recent years, a dispute began for the commercial exploration of space, where several private companies started the development of launch vehicles for the insertion into orbit of micro / nanosatellites. In this context, Brazil has made efforts to launch its space program, which since the 2000s has suffered from a lack of planning and budget. Thus, this work seeks to develop the conceptual design of a launch vehicle developed exclusively with Brazilian technology, that is, engines mainly used in sounding rockets.

The first step is to analyze the characteristics of existing rocket engines in Brazil, such as the S30, S31 and S44. Those engines are mainly used in brazilian souding rockets VSB30 and VS40. The purpose is make a adaptation in its configuration as alternative way to acess space while the project VLM it is not concluded.

With the available engine data, the initial objective is to perform a feasibility analysis. At this time, traditional rocket engine concepts such as the Tsiolkovsky equation will be used.

$$\Delta V = I_{sp}g_0 \ln \left(\frac{1 + \lambda}{\epsilon + \lambda} \right). \quad (1)$$

The initial objective is to reach a ΔV of about 9 *km/s*, with some configuration of the engines mentioned, so that it is possible to insert a small national satellite, of approximately 10kg, in orbit. The launch site is the Alcântara Launch Center, located in Brazil.

Subsequently, studies of thrust are carried out during the vehicle's trajectory, in order to assess the feasibility of inserting a nanosatellite into orbit. In this context, concepts of orbital dynamics are used for vehicle analysis.

With a preliminary positive result the aim of work is to show a complete conceptual design of a launch vehicle, arguing about its propellants, stages, combustion chamber, nozzle and other characteristics.

Some softwares will be utilized, such as MATLAB to perform analysis about rocket flight caracterics, such as a dinamic analysis of flight, considering rocket engine parameters. Also, the intention is to use ANSYS Fluent to perform aerodynamics analysis, studying mainly the drag behavior, getting maximum dinamic pressure (MAX-Q) region. Beyond that, a CAD drawing will be made using SOLID WORKS.

Therefore, it is expected to arrive at a vehicle conceptually suitable for development. Allowing existing technologies to be used in short time.