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CONCEPTUAL DESIGN OF A NANOLAUNCHER BASED AEROSPIKE NOZZLE TO SEND CUBESATS FROM MEXICO.

Abstract

The low cost, the simple design and the ease to build a CubeSat nanosatellite represents for scholars, scientists and even enthusiasts, a great opportunity to reach outer space. However, the costs to place a nanosatellite in orbit are expensive because they are carried as piggyback into bigger satellites (more than 1000 kg), which is a limitation. The required budget to launch a satellite of that dimensions start from 50 to 500 million dollars. The cost depends on the satellite mass. The launch per kg to LEO requires an estimated investment of $10,000 dollars.

Nowadays in Mexico, through its space research agency, AEM (Mexican Space Agency) in collaboration with other research institutions, such as CENTA (National Centre for Aeronautical Technologies), want to build and send CubeSats for earth observation and analysis from space, by creating small rockets to launch nanosatellites; with the purpose of a medium term to have the infrastructure to make launches in Mexico. This implies a considerable difference in budget, being able to allocate funding to research, production and trade of nanosatellites, to be destined to make the nanolauncher in our country.

This paper proposes a conceptual design of a two stage microrocket based on an aerospike nozzle capable of transporting up to three CubeSats of 1U or other configurations in LEO (Low Earth Orbit), contained in a P-POD (Poly-Picosatellite Orbital Deployer) device whose maximum payload mass is 5 kg. The structural design of the rocket is being done with CAD software assigning geometrical and aerodynamic parameters. For the RLC (Rhumb Line Control) a LQG (Gaussian Quadratic Linear) controller is proposed using a gimbal, control simulations will be integrated with the structural design. The development of a recovery system for the reuse of the rocket model is also desired.

The conceptual design was made based on the technical specifications of the SS- 520-5 and the Electron rockets. The main characteristics of these rockets are:

- The SS-520-5 rocket with a length of 9.54 m developed by JAXA (Japan Aerospace Exploration Agency), is the smallest rocket that has sent a payload, a 3U CubeSat with a mass of 3 kg, in an orbit of 190 x 2000 km in height.

- The Electron rocket, developed by Rock Lab from USA and New Zealand, with a length of 17 m and payload capacity from 150 to 250 kg.