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THE ARCHITECT DEVELOPMENT OF THE LIGHT LAUNCH VEHICLE FIRST STAGE

Abstract

The first stages of Launch Vehicle(LV) have well-tested design schemes to orbital a payload injection. But the applied technologies have reached their level best.The efficiency of application of just a liquid-propellant rocket engine(LPRE) for heavy LV is more justified than for light LV. As the capacity of LV increases faster than a cross-section area of LV, so a ratio of payload to the whole weight is better for heavy LV. I suggest a new design scheme of the first stages of light LV. As the first stages work longer in the atmosphere so I found the way to combine the aviation and rocket engines together(Ramjet and LPRE). The results were analysed by specialists and I can predicate, that using Ramjet with LPRE gives more propulsion at lower mass of stage, as a bigger bulk of oxidizer is taken from the air. In the work I used the research of Florida Institute of Technology (Mechanical and Aerospace Engineering Department) about a Ramjet behavior. I have optimized the strategy of using both engines behavior and I have got the scheme of engines burn: Engine Ramjet Engine. The first burn of a LPRE is necessary to gather velocity needed to burn a Ramjet, the second one is to climb and gather velocity to the next stage. The construction of the first stage was designed with aerodynamic surfaces which give the opportunity to safe landing after a separation. Using a Ramjet(with an expanding and convergent diffuser) outside of stage can provide the opportunity to turn the vector of propulsion at 180 degrees. This is a real help in the opportunity of easier landing. During a work of stage the maximum loads happen at the zone of dynamic velocity pressure in the atmosphere. The construction arrangement of the stage was designed in according principle of a dry bay. This indicates that we can applay such an structural material as duralumin instead of aluminium-magnesium. As a result we get more load-carrying ability. This stage was designed to LV to use an air launch. The weight of LV is 40000kg, a payload is 1300kg, the orbit is 185km, inclination is i=0 degree and velocity is 7,8km/s Thus using the first stage with complex engines(Ramjet+LPRE) for light LV gives better result as typical one with a LPRE or solid-rocket booster. This scheme was approved by Yuznoye Design Office as it could be realized in the nearest future.