

6/18/14

“Sprite, a Very Low-Cost Launch Vehicle for Small Satellites”

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The Scorpius low-cost launch vehicle architecture greatly reduces the cost of space access due to its emphasis on designing specifically for low total life cycle cost. Due to its simplicity, a pressure-fed launch vehicle is low in cost compared with pump-fed and solid rockets. The pressure-fed approach in the Scorpius architecture is enabled by the development of all-composite propellant and pressurization tanks, which have about half the mass of metallic tanks. The low-cost Scorpius “Pressurmaxx” composite tanks comprise half the dry mass of the vehicle. In addition, a high-performance pressurization system using heated helium reduces the mass of the pressurization system by half. Ablative, LOX/kerosene engines are of moderate performance and very low cost. The mass savings of the tanks and pressurization system together with the moderately performing engines yield a 3-stage launch vehicle that can be much lower in cost than a high-performance (pump-fed) vehicle. Sprite, which delivers 480 kg to LEO, is the vehicle in the Scorpius family of low-cost, scalable launch vehicles that has progressed the furthest in terms of development. Propellant tanks, the pressurization system, and engines of the size needed for Stages 1 and 2 of Sprite have been built and tested. A prototypical “pod” of Sprite has been flown suborbitally. This paper describes the Scorpius architecture, its scalability into a family of low-cost vehicles capable of payloads to LEO from 100 kg through 9000 kg and larger, and the responsiveness of the vehicles. The configuration of Sprite is presented, its performance and sample missions are shown, and a market analysis is provided.