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Access to Space for Small Satellite Missions (5)

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## WHERE ARE ALL THE SMALL SATELLITE LAUNCH VEHICLES?

**Abstract**

This paper presents an analysis of the small satellite market and its correspondent launch vehicles. The miniaturization of electronics, together with reliability and performance increase and reduction of cost, have allowed the use of commercial-off-the-shelf (COTS) in the space industry, fostering the Smallsat use. Nowadays, there are satellite constellations that provide global communication and high-resolution Earth imaging services with satellite masses of less than 100 kg down to just a few kilos. A comprehensive analysis includes 863 Smallsats under 500 kg wet mass launched between 1995 and 2014, comprising about one third of all satellites launched in that period. This paper identifies the challenges involved in the development of Smallsats, including: Telemetry, Tracking and Command; Satellite propulsion; Scaling down; Competitiveness; and Regulatory issues. Future scenarios for the different Smallsat categories are proposed to address the questions of how big this market will become and when it is expected to happen. The satellite launch vehicle business, on the other hand, has been established to carry payloads of thousands of kilos into low Earth orbit (LEO), and has not adjusted itself to the market of Smallsats. As a matter of fact, there is only one Micro-LV (payload mass 500 kg) commercially available today, but with a launch cost in the order of USD 50 million. It is concluded that the boom of Smallsats, brought about by miniaturization of electronics, was not followed by the decrease of the payload capacity of launch vehicles. Several initiatives around the world developing Micro-LVs have been identified, but it is uncertain if they will succeed as a viable commercial option, since most of their announced price tags seem unrealistic. Satellite launch vehicles, regardless of their sizes, have similar complexity and are inherently costly. Unless substantial government funds are provided for Infrastructure; Development; Qualification Flights; and Range and Ground Operations, or some disruptive propulsion technology comes into place, their final launch cost will limit their competitiveness.

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