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VALUE ANALYSIS OF HIGH THROUGHPUT SATELLITES (HTS): TECHNICAL AND MARKET CONSIDERATIONS, AND DESIGN IMPLICATIONS

Abstract

High Throughput Satellites (HTS) are a class of communications satellites that provide significantly more throughput, typically an order of magnitude or more, than traditional Wide Beam systems for the same amount of allocated bandwidth. The recent developments in the satellite power systems (20kW class), payload and antenna technologies, radio frequency link, TCP acceleration and Ground terminal technologies, enabled a new generation of HTS with more than 100Gbps of capacity to be launched into orbit. More of these satellites with even higher capacity at the level of 350Gbps will be in service in the near future. With the rapidly growing demand for ubiquitous capacity and telecommunication services, it is expected that HTS will significantly disrupt the traditional business model of some satellite operators if they fail to adapt (e.g., from leasing MHz to leasing Mbps), and will provide a booming opportunity for others, including new entrants. For HTS to compete with, and be disruptive for terrestrial networks (cable, fiber, and cellular), not just traditional satcom, operators have to carefully assess and tightly control two critical system-level metrics: the HTS cost per bit per second on the one hand, and the system value profile on the other hand given the market uncertainties. In this work, we address the second topic. First, we briefly review the value profile of traditional communication satellites to serve as a background against which the HTS value analysis will be contrasted. Second, we develop a cost model for HTS based on empirical data from the past 10 years of launching such satellites. Third, we develop a revenue model for HTS with multiple revenue streams. The model accounts for different end-user download speeds, multiple loading scenarios for the satellite, and different ARPU. Technical parameters of the satellite are also accounted for, including the number of spot beams, the selected frequency and allocated bandwidth to the satellite, and the total on-board capacity. Fourth, the cost and revenue models are integrated within a stochastic simulation environment, and Monte-Carlo runs are carried out to assess the value (distribution) of the system as a function of various parameters. The end-result is a decision analysis tool for different stakeholders to examine trade offs in HTS design and valuation.