32nd IAA SYMPOSIUM ON SPACE POLICY, REGULATIONS AND ECONOMICS (E3)
Space Economics from Apollo to Tomorrow (3)

Author: Mr. Fan Geng
Georgia Institute of Technology, United States, fgeng3@gatech.edu

Mr. David Gomez
Georgia Institute of Technology, United States, dgomez32@gatech.edu
Mr. Yue Guan
Georgia Institute of Technology, United States, scott.guan@gatech.edu
Prof. Joseph Homer Saleh
Georgia Institute of Technology, United States, jsaleh@gatech.edu

UNDERSTANDING HIGH-THROUGHPUT SATELLITES: MARKET DISRUPTIONS, TECHNOLOGY, AND VALUE ANALYSIS

Abstract

High Throughput Satellites (HTS) are a distinctive class of communication satellites that provide significantly more throughput per allocated bandwidth than traditional wide-beam communication satellites; they are poised to disrupt and dominate the satellite communication market. The objective of the present work is both to develop a decision-analytic framework for assessing the value of HTS, and to provide results relating the value levers, uncertainties, and investment outcomes in these systems for satellite owners and/or operators. In doing so, we provide an integrated analysis of design, cost, and service pricing considerations of HTS, thus enabling the (stochastic) assessment of the net value of these systems. We first review the value model of traditional wide-beam communication satellites. This model serves as the background which we build upon and extend to develop a value model of HTS. Second, we develop the cost and revenue model of HTS and identify key features that distinguish them from the cost and revenue model of traditional wide-beam communication satellites. Both cost and revenue models of HTS are significantly more involved than the corresponding models for traditional wide-beam communication satellites. For example, the HTS cost of operation model captures the Customer Acquisition Cost (CAC) for increasing the number of subscribers. To build the HTS revenue model, we develop a hybrid, data-driven and scenario-based load factor model that combines historical data based on financial records from current HTS operators with extrapolations based on best-, nominal-, and worst-case scenarios. The revenue model accounts for a set of parameters such as total throughput, service pricing, and user activity. Third, we integrate the cost and revenue model within a stochastic simulation environment and perform Monte-Carlo analysis of the net present value (NPV) of HTS. The results allow us to determine under what conditions, and for what combinations of design and operational choices, as well as market scenarios, HTS are value-positive. We provide both expected values and uncertainty (distribution) analyses to allow decision-makers with different risk-profiles to tailor their decisions for acquiring and operating HTS (or not). A key finding from our analysis is that while HTS, under certain conditions, can have significantly high returns (higher than traditional wide beams), their value distribution is also more spread out and uncertain, with value-at-risk under some operational and market conditions, and value-negative under others.