IAF HUMAN SPACEFLIGHT SYMPOSIUM (B3)
Commercial Human Spaceflight Programs (2)

Author: Mr. Markus Guerster
Massachusetts Institute of Technology (MIT), United States, guerster@mit.edu

Prof. Edward Crawley
Massachusetts Institute of Technology (MIT), United States, crawley@mit.edu
Prof. Richard de Neufville
Massachusetts Institute of Technology (MIT), United States, ardent@mit.edu

SUBORBITAL SPACE TOURISM - A COMMERCIAL FEASIBILITY ASSESSMENT

Abstract

This paper provides an analysis of the commercial feasibility of the suborbital tourism market while taking into account the large uncertainties in the demand. Making a decision whether to enter this market or not, and more generally deciding which commercial strategy to choose, becomes an even greater challenge in the face of these large uncertainties. Since it is unlikely that future demand forecasts will be significantly more precise, an analysis which takes these uncertainties into account is needed. Our work addresses this problem by using a Monte Carlo Simulation to calculate the distribution of possible results in commercial terms (NPV developed from a discounted cash flow analysis). By conducting a sensitivity analysis, we identify the most impactful factors in development and create a probability distribution of their uncertainties. We implement several decision rules to simulate the different commercial strategies a company in this sector might have. Previous work done by the authors defined a design space of 33 suborbital vehicle architecture and optimized these with respect to mass and risk [1]. We choose optimal architecture #4 for the purpose of this paper, which is similar to XCOR's Lynx. Data from studies such as those by the Tauri Group [2, 3] and Futron [4, 5] are used to model the distribution of the demand and its uncertainty. The cost model is mainly based on cost estimation relationships from Koelle [6]. The main result of our analysis is that with the best commercial strategy, suborbital space travel is likely to become profitable, even with a discount rate of 20%. The average expected NPV for this dominant strategy is $3.8 billion, with a 5% chance of incurring losses. We conclude that the suborbital tourism market can be made commercially attractive.

[1] M. Guerster and E. F. Crawley, "Architectural Options and Optimization of Suborbital Space Tourism Vehicles," presented at the IEEE Aeroconf 2018, Big Sky, MT, 2018.

[2] T. T. Group, "The U.S. Commercial Suborbital Industry: A Space Renaissance in the Making," Federal Aviation Administration2011.

[3] T. T. Group, "Suborbital Reusable Vehicles: A 10-Year Forecast for Market Demand," Federal Aviation Administration2012.

[4] Futron, "Space Tourism Market Study," 2002.

[5] Futron, "Suborbital Space Tourism Demand Revisited," 2006.

[6] D. E. Koelle, Handbook of cost engineering for space transportation systems, Revision 3 ed. (Report, no. no TCS-TR-190). Ottobrun, Germany: TransCostSystems, 2010, p. 266 p.