IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Small Launchers: Concepts and Operations (7)

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COST ESTIMATION OF SMALL AND MEDIUM PAYLOAD COMMERCIAL SPACEFLIGHT LAUNCH SYSTEMS

Abstract

Evaluating costs and price points of future space transportation systems, in particular launch vehicles, is an important capability required by the UK Space Agency. The Agency's Office of the Chief Engineer OCE has a core task to progress research into space systems, to support activities such as planning of future programmes, and assessment of grant funding and licensing applications. Over 100 small companies claiming to be developing new launch systems are currently identified, many have indicated an interest in operating from the UK through launch, spaceport operations and Earth return (reentry) licenses under the 2021 Space Industry Regulations. Assessing and comparing the basis and credibility for launch prices quoted across the industry, and evaluating the competitiveness of commercial spaceflight offerings based at the UK's multiple horizontal and vertical launch site requires end-to-end modelling of launch system costs.

The UKSA OCE supported by UKLSL, initiated an activity in late 2021 to develop a launch system cost-estimating tool. The activity initially compared existing COTS parametric models, including the widely used TRANSCOST. The comparison identified numerous commercial and non commercial packages, a strong dependence on mass based parametrics, and some validation against actual launch system costs. Potential to build cost modeling into a wider model based systems engineering or MBSE capability was assessed. The first part of this paper presents a brief summary of different parametric modeling tools, and a primer on cost sensitivities to the many aspects of launch systems and their operations. The second part covers the UKSA / UKLSL approach to developing a simple, modular and extendable tool able to evaluate small and medium class vehicles based on different architectures and able to deliver up to 5000kg into LEO. These are of most interest to the UK in the next decade. The third part of the paper evaluates our model based approach against a reference small launch system. We address development, manufacturing and operations costs, and some of the unique features of small, commercially funded newspace companies such as vertical integration or ownership of the majority of the supply chain, and commercial

financing. The final part of the paper gives our insights into how novel, reusable systems stages can be evaluated and compares the accuracy of the model to published data on the cost of various launch systems and services.