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COST ESTIMATION MODELING IN THE ERA OF 'NEW SPACE' COMMERCIAL SYSTEMS

Abstract

A variety of modeling tools and templates have been developed within the aerospace industry since the 1950s to better anticipate the schedules and costs of spacecraft systems development projects. Up until recent years, such efforts have been predominantly government-sponsored and have involved a range of civilian, military and national security programs. During this earlier era, developments for civilian space typically involved single – or very small numbers of identical – systems and very often specific mission requirements (for example, the Voyager program with two spacecraft designed for outer planets exploration, the Viking program with two orbiters and two landers designed for Mars exploration, and so on). Military and national security development typically involved greater numbers of systems, but always with tight restrictions on knowledge about the projects. Cost modeling tools for such project exist, such as the famous "NAFCOM" model (NASA-Air Force Cost Model). However, such tools have always depended on 'tweaks' provided by subject matter experts (SMEs). Now, commercial 'new space' projects are fast becoming the largest share of new developments – even when the systems are being created to provide services to government missions and operations (for example, the International Space Station (ISS) Commercial Cargo program, the ISS Commercial Crew program, and others). Essentially all commercial systems – including space systems – involve planning to manufacture many, many copies of a given system. The planned 'mega-constellations' in low Earth orbit (LEO) are the current pinnacle of commercial spacecraft 'production' – such as StarLink, the Kuiper System, and others. Internal data on such projects are closely held by the companies involved. How then for external observers – perhaps policy makers or investors – to frame 'reasonable' estimates for the costs of such projects?

This paper will review some past examples of estimation tools, identify similarities and differences among various systems and projects, and lay out a new, integrated methodology for assessing the technology readiness and risk – and the expected costs – of 'new space' projects. Several prospective applications of this new modeling approach will be presented, along with directions for future study.