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COST ANALYSIS BARRIERS TO COST-SAVING INNOVATIONS

Abstract

When innovations produce significant savings in the cost of spacecraft, they also produce discontinuities in the data series that drive parametric cost models. Reliance on parametric cost models for the early and middle phases of cost estimation can therefore produce a barrier to new innovations – the models tend to show that costs will be unchanged or even increase. Improving cost analysis could avoid this barrier.

Many innovations are being proposed for spacecraft engineering. Five that offer opportunities to reduce spacecraft costs are disaggregating mission functions onto many spacecraft, using standard commercial satellite buses, standardization and modularization at the system and component level, avoiding the costs of meeting tight mass limits by purchasing additional launch capability, and adopting commercial design principles.

Individually and together, these innovations can pose a severe challenge to spacecraft cost estimation. To the extent that these innovations produce significant changes in spacecraft engineering and the costs of spacecraft design and manufacture, they will to the same degree produce discontinuities within the historical data series that drive parametric cost models.

There are possibilities for improving the scope, accuracy, or precision of each of the three major types of cost estimation. Improvement in analogy estimation seems to have been neglected in recent years and may therefore provide opportunities for breakthrough results. There are indications that estimation by analogy never had to perform as badly as has been portrayed. With the parametric models handicapped, estimation by analogy deserves a new look.

Many of the innovations cited above involve or enable the use of legacy, standardized, or commercial components and systems. Increased use of pre-existing systems should allow earlier acquisition of vendor price quotations or other engineering cost estimates, reducing the need for parametric models to bridge the gap between analogy estimation and engineering analysis.

Some innovations may limit the utility of mass as an independent variable for future parametric cost estimates. One alternative might be to develop activity or function based parameters instead. Activity based parameters might use numbers of parts, drawings, functions, processes, manufacturing steps, tests, or other countable features as cost drivers. Combined with materials costs and time estimates, activity based parameters could produce an alternative to mass-based estimates.

Of the above possibilities, developing improved methods for analogy estimation is both the least expensive and the most promising.