



New Techniques Help to Estimate Systems Engineering and Program Management Costs for Military Aircraft and Guided Weapons

The U.S. Air Force relies on sound cost estimates to make budgetary and policy decisions regarding the acquisition of aircraft and guided weapon systems. As new programs are fielded and as acquisition management techniques change, there is a constant need to improve the tools available to cost estimators. Previous work by RAND Project AIR FORCE (PAF) has helped the Air Force improve its techniques for estimating the costs of military airframes and engines. Now, PAF is extending its work to look at “below-the-line” costs, which include items not directly associated with the development and production of the final product.

Systems engineering and program management (SE/PM) is one of the more costly below-the-line items for military aircraft and guided weapon systems. PAF studied the factors that drive SE/PM costs, surveyed government and industry personnel regarding current techniques for estimating these costs, collected historical data from several aircraft and missile development and production programs, and investigated the effects of new acquisition approaches on SE/PM costs. Major findings include the following:

- **SE/PM costs are a large portion of acquisition costs and appear to be rising for aircraft development programs.** For aircraft development programs, SE/PM represents about 12 percent of the total contractor costs. For guided weapons development programs, SE/PM represents about 28 percent of total contractor costs. SE/PM production data for aircraft showed a large amount of variation, while similar data for weapons seemed to follow a traditional learning curve.
- **Three categories of independent variables are related to SE/PM costs.** *Program scope variables* capture the size of the effort apart from SE/PM costs. *Programmatic variables* capture the duration of the effort (in the case of development) and the quantity of items produced (in the case of production). *Physical descriptor variables* are generally based on the weight and diameter of the weapon.
- **New acquisition approaches have mixed effects on SE/PM costs.** Recent innovations include minimizing military specifications to invite more commercial contractors into the military acquisition process, using integrated product teams to optimize management, and using evolutionary acquisition of new technologies to field systems more quickly. PAF found that minimizing military specifications did not have a significant effect on SE/PM costs as compared with the overall sample of programs. SE/PM costs were either similar or slightly higher for programs that used integrated product and process teams. Finally, evolutionary acquisition resulted in above-average SE/PM costs.

Based on these findings, PAF developed a set of cost-estimating relationships (CERs) that can be used to estimate the specific SE/PM cost element for development and production of both aircraft and weapons programs. These CERs are most useful in the early stages of a program’s life cycle, when little is known about the program. When more detailed information is available, other techniques (such as drawing analogies from historical programs) could be used to develop more-accurate SE/PM estimates. ■

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