Moving Satellite Communications Program to Next Level

Booz Allen Hamilton

Parametric cost estimating tools, used in an integrated team, are playing a major role in pushing the Navy's Advanced Extremely High Frequency (AEHF) satellite communications terminal program through the DoD acquisition process. Due to the lack of early technical and programmatic data and specificity, high-level, early-development-cycle cost estimates are difficult to determine and validate.

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The Navy has asked Booz Allen Hamilton to develop a business case analysis (BCA) of several acquisition options for the Navy's AEHF Terminal Program. To mitigate uncertainty, Booz Allen Hamilton uses a parametric cost estimating tool that compels technical staff to think specifically about the system's architecture and its technical definition. Upon completing the BCA, the Naval Cost Analysis Division (NCAD), formerly known as the Naval Center for Cost Analysis (NCCA), performs a sufficiency review and approves Booz Allen's initial cost estimates with minor changes.

"A major advantage of parametric cost estimating is that it provides a framework for all parties involved to consider costs early in the program formulation stage," says David Bracamonte, a Booz Allen senior associate. "Another major advantage is we are able to update the analytical framework created during the initial estimate as the program advances. This framework provides a consistent reference to understand how the cost estimates change with the program's evolution."

Bringing military communications into the 21st century

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Military satellite communication networks continue to evolve with the insertion of new technologies. Improved systems with greater bandwidth are being developed

and deployed to meet the heightened demands of national security. The AEHF satellite communications system is designed to provide assured communications to the U.S. war fighters during all levels of conflict. The AEHF system will eventually replace the MILSTAR system as the protected backbone of the DoD's military satellite communications architecture.

The overall objective of the AEHF program is to develop and field a constellation of geosynchronous satellites to provide worldwide, secure, survivable, and protected communications to all current MILSTAR and planned AEHF users. Furthermore, the system must ease operations, facilitate satellite control and monitoring, and interface with evolving terminal designs (including backward compatibility).

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The AEHF constellation consists of three cross-linked satellites covering the globe from 65 degrees north to 65 degrees south, providing 10 times the data rate currently available through the MILSTAR constellation. The Navy's AEHF terminal is a multiband, multimode terminal capable of simultaneously communicating via multiple satellites (X, Ka, & Q – all military frequencies, no commercial), leveraging a suite of interchangeable, modular components with common interfaces.

Booz Allen's support to the Navy's MILSATCOM spans more than two decades. Recently, the AEHF program has requested the company perform a BCA of several acquisition alternatives:

1) Contracting the original developer to design and build the terminal;
2) Contracting with a new developer to design and build a new terminal, using the intellectual property rights of the existing terminal; or,
3) Contracting with a new company to develop a new terminal without the use of any existing terminal intellectual property rights.

The objective of the BCA is to determine the relative economic viability of introducing competition into the program. Booz Allen, which has access to and uses a variety of parametric cost estimating tools, uses the SEER-H (Hardware Model) and SEER-SEM (Software Estimating Model) tools from Galorath Incorporated (www.galorath.com), El Segundo, California to estimate the terminal acquisition costs (development and procurement).

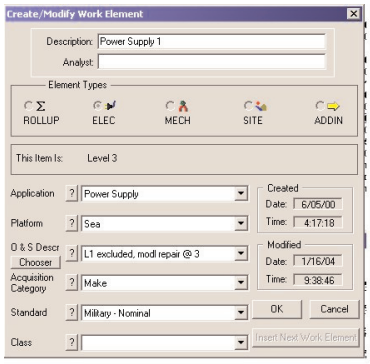
"The SEER tools are equally strong at estimating both software and hardware costs. They do a thorough job of enabling the analyst to deconstruct the system into smaller elements," Bracamonte says. "I find SEER easy to use and intuitive."

Estimating hardware and software costs

The cost estimation process for the hardware elements of the three alternatives begins by defining the architectures of the terminal, which drives discussions of the key modules such as the power supply, processors, data storage, modulators, power amplifiers, top-side equipment, etc.

Each module is modeled in SEER-H, by entering its baseline technical characteristics and intended application (i.e., military use, naval ships).

By using the knowledge bases embedded in SEER-H, the basic framework of the estimate is established. Based on the initial entries, SEER-H prompts the user to further define the technical parameters of the project.
Technical parameters may include the extent of design re-use, the development team's capability and experience, the component and material specifications, the circuit board size, the weight and component density, and the percentage of analog and digital components.



"To derive these parameters, we work closely with engineers from our firm, the Navy, and other companies involved in the project to obtain the relevant information," says Bracamonte. "The advantage of the integrated team approach is that engineers are forced to evaluate the impact of design decisions on the cost of the project early in the program formulation. This process facilitates discussion among the technical staff and elicits important design issues earlier than otherwise." The SEER-H model predicts non-recurring costs and recurring costs by identifying similar components from its database.

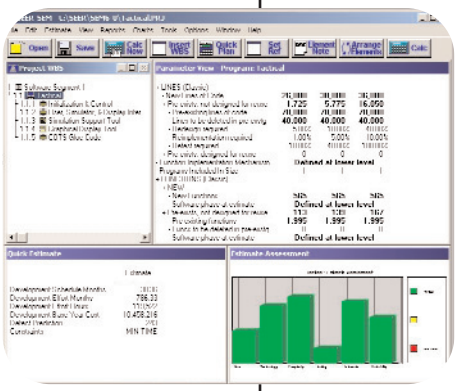
A similar approach is used to estimate software development costs. The first step is to gather information about the project, such as the software development process, the use of object oriented or structured analysis development methods, the staff experience levels, the software module sizes (lines of code or function point count), and the schedule and price constraints. Again, Booz Allen estimators work with software engineers to begin building the SEER-SEM model by characterizing the software system and its modules using various technical and programmatic parameters.

Data collected during the interview process are captured using the Notes Edit feature embedded within SEER-SEM. A skilled analyst uses the tool to estimate the cost of the software project. The estimator reviews the initial estimates with the technical staff, who correlate the results with the technical and programmatic parameters. "We asked the engineers to perform a 'sanity check,' and in a number of cases we adjusted parameters so the results made more sense," Bracamonte says. The advantage of this process is that, rather than relying on the unknown reasons of an experienced individual, the estimate along with assumptions and technical parameters is clearly documented for anyone to see and provide feedback. The model provides an audit trail of changes and is easily adjusted for changing program assumptions.

Moving the program forward

Developing and documenting detailed information about both the software and the hardware elements enables NCAD to readily assess the program cost estimate and to conduct the sufficiency review. NCAD's independent cost estimate is reconciled to the Program Estimate developed by Booz Allen. After negotiating minor differences, NCAD approves the program cost estimate. This approval enables the program to move forward into Phase II and to initiate the competitive bidding process.

Booz Allen is retained to develop the program's cost analysis requirements document (CARD) required for Phase II. This follow-on effort leverages the foundation and information established during the initial program cost estimate.



"When you use a parametric model, you reduce uncertainty by deconstructing the project into smaller, well-defined components; the cost estimate of which can be more readily critiqued by the technical and program management staff," says Bracamonte. "It takes more time up front to create a model with this level of granularity, but you ultimately save time throughout the rest of the process through reuse. You also help ensure traceability as the program evolves, increasing the confidence of the estimate."

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For more than 25 years, engineers, project managers and cost estimators throughout the world have turned to Galorath Incorporated for the industry's most comprehensive set of decision-support and project management tools for software, hardware and design for manufacturability projects. Combined with extensive consulting and support services, Galorath's SEER estimation and analysis tools derive cost, schedule and staffing estimates by assessing the interaction and impact of product, organizational and even operational variables. This parametric methodology, coupled with the industry's most comprehensive knowledge bases, creates a rapid and powerful view of the critical factors driving program decisions and success from early concepts through upgrade and maintenance phases.