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HIGHLIGHTING RAYTHEON'S TECHNOLOGY

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Raytheon's Culture of Innovation

Providing Leading-Edge Customer Solutions

Raytheon

Customer Success Is Our Mission

Using System Dynamics for Advanced Whole-Life Forecasting and Opportunity Identification

In today's do-more-with-less environment, customers and contractors must consider not only a product's development cost, but its whole-life cost as well. This is because in most cases the operations and sustainment costs are greater than the procurement cost.

Forecasting whole-life cost also helps identify opportunities to reduce cost and/or improve mission success that may be addressed during development. Forecasting whole-life cost and identifying these opportunities is often challenging. System dynamics is a new approach being successfully employed by Raytheon Integrated Defense Systems Engineering's Whole Life Engineering Directorate (WLED) for forecasting costs/performance and quantifying opportunities.

What is System Dynamics?

System dynamics is is a structured process methodology for modeling complex systems over time. First developed in the 1950s to model industrial systems, system dynamics is a proven, powerful approach that can be used to model system interdependencies to enable identification of the variables driving complex system behaviors such as reliability, availability, mission effectiveness and ultimately cost of ownership.

John P. Bergeron, director of WLED, summarizes system dynamics capabilities: "System dynamics is a powerful tool we use in assisting our customers in making strategic decisions on how best to deploy performance-based logistics programs and assure mission success. System dynamics allows us to accurately analyze the entire life cycle of a system with quantitative predictions of system performance and cost. This will enable us to grow our business by identifying and prioritizing process improvements to deliver 'no doubt' mission assurance, while limiting our risk and establishing and maintaining a competitive advantage."

Various commercially available tool suites implement the system dynamics modeling methodology. The modeler focuses on understanding and correcting the root causes of a problem through modeling the endogenous interactions within systems. These tools implement a wide range of mathematical techniques to enable systems to be analyzed dynamically across multiple levels of aggregation and unit type. This ability to take complex concurrent processes and simplify the specific behavior drivers for quantitative analysis and optimization makes system dynamics ideal for the modeling and simulation of complex, system-of-systems problems. These analyses can then be used to support fact-based decisions to reduce overall lifecycle costs.

Meeting Raytheon and Customer Sustainment Support Challenges

Increasingly complex sustainment support challenges caused Raytheon and its customers to migrate to a modeling methodology with system dynamics capabilities. Some examples of where systems dynamics has proven valuable are:

- Optimizing the repair-and-return process to shorten the repair turnaround time, thereby decreasing the cost per transaction
- Optimizing the deployment schedule for software updates to balance anticipated downtime with the upgrades' performance improvements
- Quantifying the increase in production line capacity needed to handle varying order increases to ensure that delivery commitments are met while minimizing excess capacity

System Dynamics Modeling Benefits

The systems dynamic model can be used to explore numerous less-tangible aspects of a system. For example, by utilizing a "what-if" scenario capability, we can determine how policy changes impact the system. In addition to producing the executable model, the model-building process gives the program team a greater understanding of how its individual tasks impact the system as a whole. Finally, the model allows the problem to be visualized. This has proven to be a powerful tool, promoting managerial and customer understanding and decreasing the risks associated with making key decisions on systems where there may be complex, dynamic interdependencies that need to be understood to ensure the right sets of decisions are made.

Future Use of System Dynamics

As systems grow in complexity, the use of system dynamics modeling will continue to increase. These tools have proven themselves in applications such as performance-based logistics and enhancement of agile value streams. This technique can also be applied to other program and business-focused problems. ●

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