Why Government Organizations Should Embrace Digital Engineering

Digital engineering is an innovative and holistic approach to systems engineering that uses automation and modeling to enable stakeholders to better collaborate, see potential outcomes, and make informed decisions before physical work begins – and throughout the lifecycle of a project. Though it can sound overly technical to non-users, digital engineering makes jobs easier and decision-making faster and better. And it typically provides measurable results within six months of implementation.

In an interview with MeriTalk, Mike Nash, director of engineering at General Dynamics Information Technology (GDIT), delves into the myriad benefits of digital engineering for defense, civilian, and intelligence organizations, including lower costs, reduced risk, better design quality, and a level of automation that is essential as enterprises accelerate digital modernization.

MeriTalk: You have called digital engineering "the future of modern engineering." What do you mean by that?

Nash: Digital engineering is the implementation of automation and model-based processes to systems engineering, and it's the future because the traditional way of doing engineering processes via documents is not sustainable. In this modern world, data changes constantly, and it is very connected. Document-based processes are just a snapshot in time, and errors are bound to happen if we consider them authoritative. We must capture authoritative data within models because they contain computable, structured information, allowing us to automate inefficient processes with software. Many engineers are able to automate certain aspects of their processes within the confines of a single application. When I talk about digital engineering and systems engineering, I think about the connectivity of that data across multiple applications throughout the product lifecycle process.

MeriTalk: How can you successfully bring digital engineering to a broad audience of non-technical users?

Nash: Digital engineering implementations should include a web- or application-based visual component for data consumption, which makes authoritative data available to non-technical users. This enables users to do intuitive, text-based queries on vast amounts of information. Typically, non-technical users aren't looking for a deep understanding of all relationships between data. They have a question, and they need to answer it quickly. For example, a cybersecurity expert can mine the information that's produced by engineering applications for specific metadata. That data is presented in a dashboard that is tailored to the parameters they want to see in a language they understand.

MeriTalk: Let's drill down on the specific benefits that digital engineering brings to Federal agencies. Why should Federal civilian, intelligence, and defense agencies use it?

Nash: One major benefit is cost. For example, on a recent program, we were able to integrate product lifecycle management data with system architecture data. Without this integration, users would have to license multiple tools to answer questions about how product lifecycle management data relates to system architecture data – or the agency would have to employ a large staff to expose this data manually. With digital engineering, the costs for both personnel and licensing are dramatically reduced. A second benefit is simulation, which decreases risk to your product. If you can simulate designs earlier in your process, and with richer data, you can identify defects earlier. This shortens design cycles – you're not getting too far down the road in an expensive production process with a defective product. The third benefit is reducing cyber risk. Digital engineering is a software project, so we package a digital thread in our solutions that can automatically expose in models the infrastructure that it has been deployed on.

MeriTalk: A digital thread?

Nash: Yes. A digital thread is a way to capture a use case of data – data from different authoritative sources tied together by relationships that users define. In our opinion, a digital thread is one of the fundamental concepts that enables digital engineering. For example, a digital thread that establishes traceability from requirements to design artifacts is a fundamental need in any engineering program. We don't create a data lake or data warehouse for all of the authoritative sources of truth. We use a digital thread to extract the specific data required to answer the question being asked. It's more streamlined, less expensive, and more accurate.

MeriTalk: Many new technologies face challenges in getting people to adopt them. What are some of those challenges for digital engineering?

Nash: A lot of these challenges are perception, which can be difficult to overcome. One perception is that digital engineering is expensive and adds costs to programs. In fact, it's the other way around. We have demonstratable examples showing that the cost of executing processes goes down over time when you implement fundamentally sound digital engineering. Upfront investment is required to stand up some of this automation, but it pays for itself – and more – over time. Typically, within about six months of a program start, a software release automates a particular engineering process. That's very fast in this world of software development and complex programs. Also, the customer owns everything that we deliver – the technology, the threads, and they use and maintain those for as long as they like.

The second perception is that adoption is difficult. Actually, cultural buy-in becomes relatively simple when you start to implement good digital engineering that makes people's lives easier and their jobs faster. A third misconception is that it is all or nothing. You either are digital or you are not. This just isn't true. There is an incremental approach to applying digital engineering. And that's how we do it.

This approach to digital engineering does not mean extra cost via extra documentation, which is another common misconception. That may have been true with early adopters of model-based systems engineering, but with our model automation, we're not employing humans in the loop to keep models up to date. We use our models for system design in the product lifecycle and are solving problems through automation and our usage of digital threads, which is more efficient.

MeriTalk: In May, the Army issued a directive calling for rapid adoption of modern digital engineering practices. This follows the December 2023 Department of Defense Digital Engineering Instruction 5000.97, which requires digital engineering across the life cycle of defense acquisition programs. The goal is to enable smarter, faster, data-driven decision-making. With this momentum in mind, is it fair to say that digital engineering is typically seen as an opportunity rather than a burden – even considering potential misconceptions about it?

Nash: Yes, definitely. We are seeing that numerous government agencies and other users see digital engineering as an opportunity. That is increasingly the case in defense agencies – where it is required – and civilian agencies, where it is usually not required, but we implement it because it works and gets results.

MeriTalk: GDIT recently launched the Ember Digital Engineering Accelerator, which is designed to optimize engineering processes through the system lifecycle. Please tell us a little about this solution and why government organizations such as the U.S. Space Force are interested in it.

Nash: The Ember solution is the reuse of a lot of the development work that we have done on initial digital engineering programs. Acquisition and program management and engineers within Space Force are interested because they would like to leverage this work. We have been developing digital engineering solutions for other customers for almost four years, and all of that work is owned by the government. Customers don't have to feel like they're acquiring an untested or unproven technology – they can start with something that has been deployed. The more proof points that we are able to show across more digital engineering programs, the more interested people become.