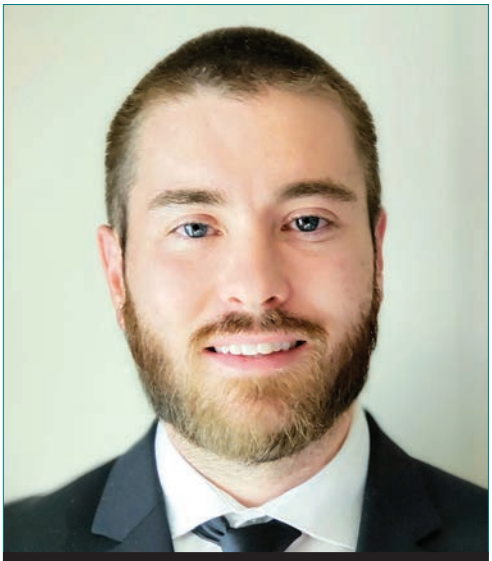


Greg Porter, Senior Systems Architect at Sev1Tech

GMC Q&A

Supporting government and military innovation

Digital thread and digital twin technology is addressing challenges such as training, production speed and quality, problem prediction, cost, and complexity for both satellite and aerospace operations. We sat down with Greg Porter, Senior Systems Architect at Sev1Tech to find out not only how NASA is using this exciting new approach but also how digital thread and digital twin technology can revolutionize military operations.

Crispin Littlehales, Executive Editor, Satellite Evolution Group

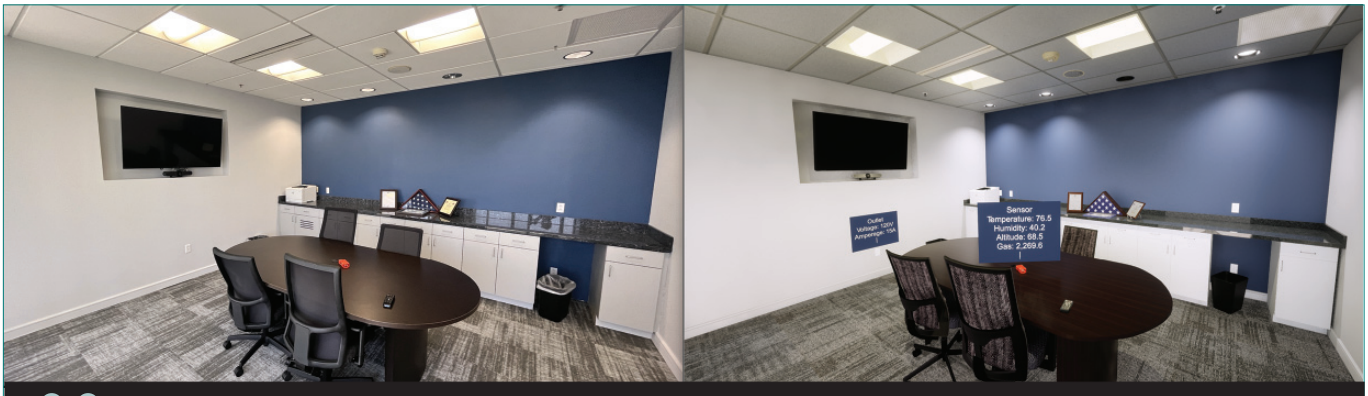
Question: When was Sev1Tech established and what services does the company provide?
Greg Porter: Sev1Tech was established in 2011 and we currently have a staff of around 1,000 people who provide IT-based competencies and mission and management services. Our IT offerings span modernization, cloud computing, development security operations, data operations, artificial intelligence (AI), and machine learning (ML). We also offer cyber protection and security as well as digital engineering. In addition to professional services, space operations, aerospace science and engineering, and force protection, our mission and management services include such things as C5ISR.

While our customers are primarily government, we have a large commercial division. That said, a lot of our commercial work is satellite-based which, in turn, supports the government.

Question: How does digital thread and digital twin technology work?
Greg Porter: I would define a digital thread as a data driven architecture that links together information generated across a product lifecycle. It works by exposing metadata from disparate systems to link information that shows the intra and inter model relations. This in turn provides a holistic end-to-end view of the data across your entire organization.

Digital twins are done in different ways by different companies. Here at Sev1Tech we build the most photorealistic digital twin possible. When you look at one of our digital twins, it should appear as if you are in that physical space, looking at that object.

Question: How can digital thread and digital twin technology address challenges such as training; production speed and quality; problem predictions; and cost as well as complexity of aerospace systems?
Greg Porter: Our digital twin platform offers a suite of capabilities that improve personal training and job preparation. They include access to online tooling or machinery, manuals, training documentation, as well as the development of canned videos that demonstrate production, maintenance, or repairs. There is augmented reality training which walks the user through individual tasks that



Digital twin office model

Photo courtesy 3rdtimeluckystudio/Shutterstock

need to be performed. We can also combine all those elements to create machinery simulators that can track how an operator performs with a piece of equipment in a real-life scenario and then throw curveballs at them to see how they would react to unexpected situations. All such elements can be made available either at one's desk or out in the field to supplement on the job training.

As for production, speed, and quality, when questions arise, the documentation and engineering processes are all tied together. They are available to whomever needs it right when they need it. That goes back to the digital thread which serves as the authoritative source of truth for all the data that goes into the digital twin. As a result, the technology greatly impacts facility improvements, tooling, management, and production planning because you've got that link to the digital thread which has the real-time documentation, real-time models, and real-time information systems that are feeding back into your digital twin.

One of the ways we help with problem predictions is through sensors. We tie real-world sensors, which can provide live feedback on machine operation, into our digital twin. We tie that in with predictive AI algorithms that we embed into our digital twin. When problems arise, those sensors alert crews when something needs to be replaced or repaired.

Because the technology enables you to combine training, the ability to increase production speed and quality, as well as to predict problems before they happen, you're reducing your cost for those systems and for your overall manufacturing process. You are also reducing complexity because you're giving that real-world training to technicians.

Add in the HoloLens augmented reality aspect coupled with a live communication link within the digital twin and it's possible for an engineer at a different site to enter the virtual environment with the technician out on the floor. That means that the engineer could draw and interact right in the technician's environment to help solve an issue.

Question: How is that done?

Greg Porter: If I am wearing a HoloLens, which is the augmented reality space, I wouldn't physically see the other engineer but he or she could draw a circle around my computer screen and then walk me through something. I'm seeing what they draw in real time, in my physical space, but it's a virtual object that they're drawing.

Question: Do you have a productized solution or is each solution customized?

Greg Porter: We do have to model for every use case, meaning if there's not blueprints available, we'll take 3D laser scans of the physical space and the physical objects. Then we create the 3D models for that. The software used on the back end to do all that can carry across between different programs and different use cases so we're not rebuilding that every time. The same goes for the digital thread.

Something that separates us from a lot of our competitors is

that our digital thread technology can connect to virtually any software that has an application programming interface (API). This means our customers don't need to purchase a proprietary software suite and migrate all their existing data models and workflows into the new software.

Question: Are there other challenges to adopting digital thread and digital twin technology?

Greg Porter: We do see that some people do not realize the full benefit and potential of having both the digital thread and the digital twin. Even when manufacturing is not involved, a digital thread is still very useful because you are still able to understand how each of your data interacts and affects each other from end-to-end. In a manufacturing use case, you can then throw the digital twin on top of that to get that full real-time view into your environments. People do need to change the way they think about things, but once a person understands the potential a whole new world of possibilities opens.

Question: Why is this approach so beneficial for the satellite and space industry?

Greg Porter: One aspect of the digital twin which makes it very useful for the satellite industry is that during the manufacturing process, you can model and work in the digital twin space and simulate things far more quickly and cost effectively than building a physical representation. Once a satellite is deployed, it's important to understand how that satellite is operating. It's important to know if it is going to experience an outage and if there is something that can be done to prevent such an event. A digital twin can give you the ability to see all of that, not only in real-time, but also in the future. Because you are collecting that data, you can calculate the historical data and you are able to predict and prescribe fixes before they even happen.

Question: Is this kind of technology being used by the military yet?

Greg Porter: There is a huge case for digital thread and digital twin technology when it comes to the military. It is being used in different facets of the military right now. In fact, the military spent a billion US dollars on Microsoft's HoloLens. They've been exploring different ways on how to get a return on their investment. I think a big piece of that is through digital twins and it can be used for training on how to set up equipment out in the field. Instead of working with the physical equipment, they could work with holographic images and get that training accomplished without ever needing to touch the actual equipment. This would save on costs and opens different avenues of communication out in the field. If a soldier is wearing a HoloLens or some other augmented reality type goggle, someone back at base could draw or write or interact within their physical space.

"I would define a digital thread as a data driven architecture that links together information generated across a product lifecycle. It works by exposing metadata from disparate systems to link information that shows the intra and inter model relations. This in turn provides a holistic end-to-end view of the data across your entire organization."

Question: What are you hearing from NASA?

Greg Porter: You cannot talk about NASA and digital twin technology without mentioning John Vickers, the director for the NASA division called the National Center for Advanced Manufacturing (NCAM). He is credited for coining the term "digital twin" and has long been a huge proponent of the technology.

Sev1Tech is working directly for John Vickers on building a digital twin of the Michoud Assembly Facility which is where NASA builds its rockets. We're directly supporting the Artemis program, including the core and upper stage rocket as well as the Orion crew capsule. NASA's goals are to improve the efficiency and the quality of maintaining not only the facility but also managing the needs of the NASA programs which will ultimately lead to decreased downtimes, improved communication, and lower costs. Sev1Tech's vision is to expand across NASA. We would like to see all the agency's sites incorporate digital twins. We believe that is possible, using the digital thread, to be able to connect the entire NASA ecosystem together.

Question: How do you see aerospace technology for NASA and the military unfolding in the next 1 to 5 years?

Greg Porter: I see an increased speed and evolution of technology and iteration of design and desire. Over time, we're going to learn more about how to accomplish things which, in turn, is going to inspire us to do more and explore more avenues that we haven't even dreamed of yet. Sev1Tech's role is to continuously leverage the technologies available and to develop new technologies to meet the unique needs and challenges of NASA as well as our other customers. The benefits realized through utilizing the digital twin at the Michoud Assembly Facility is going to lead to broader implementation of the system across other NASA facilities and programs. **GMC**