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DeepDives

Software Factories Driving Modernization at DOD

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From the writer's desk

Kate Macri, Deputy Editor

Teaching DevSecOps to Service Members

Software factories are the Defense Department's secret sauce to IT innovation and modernization. By accelerating software development cycles and clearing obstacles for the military departments to experiment with DevSecOps, Pentagon leadership is betting on in-house innovation to prepare DOD for future conflicts, which will combine kinetic and information warfare.

Senior defense officials recently said they need more software factories to meet mission needs. As software factories continue developing new capabilities to modernize weapons systems and information exchange, military service branches seek new opportunities to launch specialized software factories and teach every soldier, seaman, airman and Marine how to code and create new applications to use on the battlefield.

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Marine Corps Launches First Software Factory, Taking Notes from Ukraine

Future Marines need to know how to shoot, move, communicate and code, according to software leaders at the Marine Corps.

BY KATE MACRI

The Russia-Ukraine war informed the vision of the first U.S. Marines Corps Software Factory launched earlier this year, the factory's director told GovCIO Media & Research.

Future warfare will be "highly lethal, contested, disconnected and pretty ambiguous," said Marine Corps Software Factory Director Lt. Col. Charlie Bahk, highlighting the need for Marines who can solve problems quickly on the battlefield.

This is where software solutions come into play.

"It's all about pulling your decision-making cycle as much as possible," Bahk said. "You want to be faster than the other guy. You want to ingest conditioned and curated data and information from all your sensor networks out on the battlefield; you need to be able to ingest and make sense of that and act on it faster than your adversary. We're seeing this in the Russia-Ukraine conflict right now, where they have conscripted up to 300,000 software developers to gain the tactical advantage and it's a little bit of the same mindset. It gives us that ability to utilize organic, active duty and reserve component Marines who have the operational experience that have been serving down at these tactical level units, breathing the same air and chewing the same dirt with these commanders, and truly, intimately understanding these problems and working on solving those problems." (ctd.)

Photo Credit: Lance Cpl. Earik Barton, 1st Marine Division/DVIDS

“We would love for the Marine Corps Software Factory to be an opportunity that’s available to any Marine because that diversity of operational experience is very important and enriches this solution development process for Marine problems at the tactical edge.”

— Marine Corps Software Factory Director Lt. Col. Charlie Bahk

Software to Meet Mission Needs

The latest software factory within the Defense Department ecosystem highlights an accelerating cultural shift to transform military service members into software developers and engineers who can rapidly prototype new solutions anytime, anywhere to meet mission needs at the speed of relevancy.

The department’s software modernization strategy, released in early 2022, vaulted software factories to the forefront of DOD software innovation and asked all of DOD to follow their lead.

Software factories within the Department of the Air Force, Army and Navy have already impacted defense tech modernization in significant ways.

Air Force CIO Lauren Knausenberger and CTO Jay Bonci credited software factories with helping pave the way to zero trust implementation at the Air Force, while Air Force BESPIN Software Factory and Navy Black Pearl Software Factory described how their emphasis on DevSecOps is critical to actualizing DOD’s Joint All-Domain Command-and-Control (JADC2) initiative.

“To get that speed to the warfighter, we have to have that cloud everywhere in the world and have that software on demand,” Knausenberger said at the Air Force Summit last year.

Before the official launch of the Marine Corps’ first software factory, Bahk was leading rapid software development solutions to meet critical mission needs. Last year, the 2nd Marine Division called Bahk asking for a software solution maximizing maritime commercial radar capabilities.

“We scoped the problem to design the solution, built it and then delivered it all within 90 days,” Bahk said. “And then, all the intelligence units across all [Marine Expeditionary Forces] started to use this application, and it gained widespread adoption to where the acquisition community is starting to talk about how to or whether it should be rolled up into an enterprise-level solution.”

Bahk wants to replicate this success story through the new software factory. Marines are known for being able to solve problems with limited

resources, he said, so the next step is for every uniformed Marine to be able to solve a software problem.

"It's all about outcomes for Marines, right? It's all about increasing what's [valuable] for the Marines at the tactical edge with solutions that are built by Marines, for Marines, and these Marines are there, they're informed by their operational experience. That's the secret sauce."

The new Marine Corps Software Factory aims to align with Deputy Secretary of Defense Kathleen Hicks' vision for IT modernization at DOD, Bahk added.

"We are a part of a broader ecosystem. She wanted a department-wide, modernized software development ecosystem," he said. "With all of the different software factories across all the different services within the DOD, we are all a part of that ecosystem. And they take it seriously. [We] keep each other informed on what the latest is because this is the new frontier."

Supporting a Stronger Workforce

The new software factory also aims to address current workforce gaps at DOD, such as the cyber workforce, by upskilling Marines. The DOD CIO office recently released a cyber workforce strategy to address recruitment and retention challenges with DOD civilians and service members, highlighting competition with industry as a major challenge, but also an opportunity to upskill and retrain civilians and service members to increase their value.

"We haven't done a good job of that in the past," said Patrick Johnson, who leads DOD's Workforce Innovation Directorate, during a call with reporters March 9. "We're not going to hire our way out of this. It's time to grow our own, build our bench and bring on more entry level positions and train them."

Marketing the mission is a big selling point for recruitment and retention

Photo Credit: Andrew Angelov and Vintage Tone/Shutterstock

according to DOD workforce leaders, including Chief Digital and AI Officer Craig Martell.

“This [software factory] provides an opportunity for our Marines to learn very tangible and valued skillsets alongside industry experts,” Bahk said. “They’re all doing this while they’re executing a mission that increases with value to the service and also makes them marketable to industry. What we’re seeing with the Army Software Factory is that if you give service members the opportunity to do meaningful work, tied to a mission that matters, they’re more apt to staying in, and we’re seeing that empirically. Moving forward, we would love for the Marine Corps Software Factory to be an opportunity that’s available to any Marine because that diversity of operational experience is very important and enriches this solution development process for Marine problems at the tactical edge.”

According to a popular Marine tagline, every Marine should know how to shoot, move and communicate, Bahk said. But a good friend of Bahk’s, Lt. Col. Sam Gray, came up with a new motto to represent the future of the Marine Corps more accurately with the launch of the new software factory.

“In the future, Gray said every Marine should know how to shoot, move, communicate and code,” Bahk said.

Photo Credit: DVIDS

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DeepDives

Creating a software factory ecosystem at DOD

A department-wide software factory ecosystem will allow the Defense Department to continuously deliver software capabilities to meet specific mission needs and drive innovation.

Creating a mature software factory ecosystem across the Defense Department will require

Increasing software factory adoption

Leveraging the existing software factories and adding new ones is needed to meet the mission

Enabling sharing across DevSecOps organizations

Trust and sharing across the ecosystem promotes a culture of collaboration

Advancing access to software capabilities

DOD needs to adopt a methodology that allows its operational systems to be integrated by design and rapidly incorporate new products

Driving software development innovation

As advancements continue to take place, DOD needs to stay at the forefront of software development research

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Why DOD Needs Software Factories

Software factories improve data interoperability for JADC2 and align upgrades to weapons systems with DOD priorities.

Christopher Yates, Principal Chief Architect, Red Hat

What are some current challenges around software modernization within the Defense Department, and how do you see software factories playing a role in modernizing defense software for the future fight?

Yates DOD faces several challenges in software modernization, the largest three being acquisition, maintenance and certification. From an acquisition perspective, DOD faces many challenges in the regulations and processes that are instituted, justly, to ensure the proper stewardship of public funds. While this model may be appropriate for the acquisition of standard supplies, uniforms, tools, desks and even commercial off-the-shelf software products such as word processors and spreadsheets, the model does not account for the iterative and evolving nature of bespoke software or the need to constantly update these information systems. The commercial industry has largely adopted software development practices focused around iterative, incremental, rapid cycles of innovation in virtuous feedback loops.

Because of the acquisition models DOD follows to acquire custom software, the software and its source code are often owned by a non-governmental entity, such as a systems integrator, defense contractor or commercial vendor. This introduces

challenges to the maintenance needs for DOD. If DOD doesn't own the software and its source code, the ability to modify and maintain the software may be a challenge due to licensing models, vendor release cycles, and the commercial entities' profit-motivated priorities to add features or fix bugs that may not align with DOD needs.

Lastly, certification requirements, the acquisition cycles and maintenance challenges associated with traditional software practices lead to sophisticated, complex certification processes to integrate changes on a weapons platform. Think of the many different systems on a tank, or an aircraft, or the unbelievable array of systems on an aircraft carrier. The ability to test and integrate all these systems is a serious labor and coordination challenge. To reduce this complexity and risk, DOD focuses on a cadence of upgrade and certification that is often longer than 24 months.

By moving toward adoption of in-house software factories, DOD will be able to implement automated testing to shorten the integration and certification processes, resulting in the ability to field new capabilities on a faster cycle. Applications produced by these software factories will have features aligned with DOD needs rather than the priorities of external entities. And finally, the adoption of software factories will change the models DOD uses to acquire software because the software will be more visible and pliant to the needs and capabilities of DOD to modify it for its purposes.

What are some of the successes or use cases for software modernization you've seen that could make a difference in the defense space?

Yates The adoption of software factories and accelerating software modernization is a critical need for the success of DOD's multi-domain operations objectives, such as Joint All-Domain Command-and-Control (JADC2). Multi-domain operations is a concept that aims to build and maintain

"The adoption of software factories will change the models DOD uses to acquire software, because the software will be more visible and pliant to the needs and capabilities of DOD to modify it for their purposes."

— Christopher Yates, Principal Chief Architect, Red Hat

advantage in conflicts against near-peer and peer adversaries by coordinating actions and assets across the five domains of air, land, sea, space and cyber. To accelerate the observe, orient, decide and act (OODA) loop, the platforms that operate within and across the five domains must be able to communicate with each other and with battle space commanders to identify opportunities to gain, maintain and exploit advantage. The ability to integrate these systems, create holistic pictures of the battle space in real time, and enable coordination across platforms and domains is critical.

Machine-assisted decision-making is a vital component of how DOD will gain, maintain and exploit advantage. To achieve these goals, the various assets fielded in a conflict will need to be able to communicate with each other in a dynamic, reconfigurable, re-composable, and robust fashion as assets will join and leave the conflict. Furthermore, assets available from conflict to conflict are not guaranteed to be consistent. To develop dynamic, reconfigurable, re-composeable integrations on demand, DOD will need to rely on adaptive infrastructure and information systems to share data. While weapons platforms have traditionally been designed as monolithic, isolated information systems, these new demands require new capabilities. These new capabilities require the evolution of information systems supporting and enabling these weapons platforms, and rapid development of new capabilities requires a maturity of software development provided by software factories.

What should DOD prioritize over the next year while building out new software capabilities in a hybrid-cloud environment?

Yates While the adoption of software factories will be an important investment in the modernization of DOD's software acquisition and maintenance models, there are still many opportunities to improve traditional software systems through automation. Software doesn't just provide the interface for warfighters to operate their weapons platforms, it also controls the networks those platforms communicate across and defines many of the infrastructure capabilities those applications sit upon. Automation impacts the ability to operate or deploy the software on these platforms and brings efficiencies to the testing and certification processes for these platforms. By investing in automation, DOD can see returns on its investments by ensuring consistency, reducing manual overhead, increasing robustness and enabling rapid deployment of capabilities.

Photo Credit: Blue Andy/ShutterStock

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A path to modern day software delivery

- DevSecOps
- Automated governance
- Trusted software supply chain

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How Software Factories Position DOD to Win

Kessel Run has been quietly proving how achieving a software-empowered organization transforms all facets of warfighting operations.

BY ANASTASIA OBIS

Before standing up the Kessel Run software factory in 2017, Jeremiah Sanders oversaw the planning, execution and assessment of air campaigns at the Air Force Air Operations Center program office when the Defense Department was "perpetually stuck" in the development process.

"The impetus for change was we needed to do better not just in terms of not wasting money, but our legacy system was held together with duct tape and baling wire," Sanders said at at an April event in Washington, D.C. "The functionality of the legacy software was so bad that we had mission operators abandoning the mission software and using whiteboards, Microsoft Office products, chat boards, hand paper calculations for doing things like figuring out where we're going to drop bombs."

Kessel Run partnered with Pivotal Labs to help the Air Force inform the organizational transformation model. Less than three months later, the team put its first software product in the hands of airmen, helping DOD achieve continuous capability delivery for the first time.

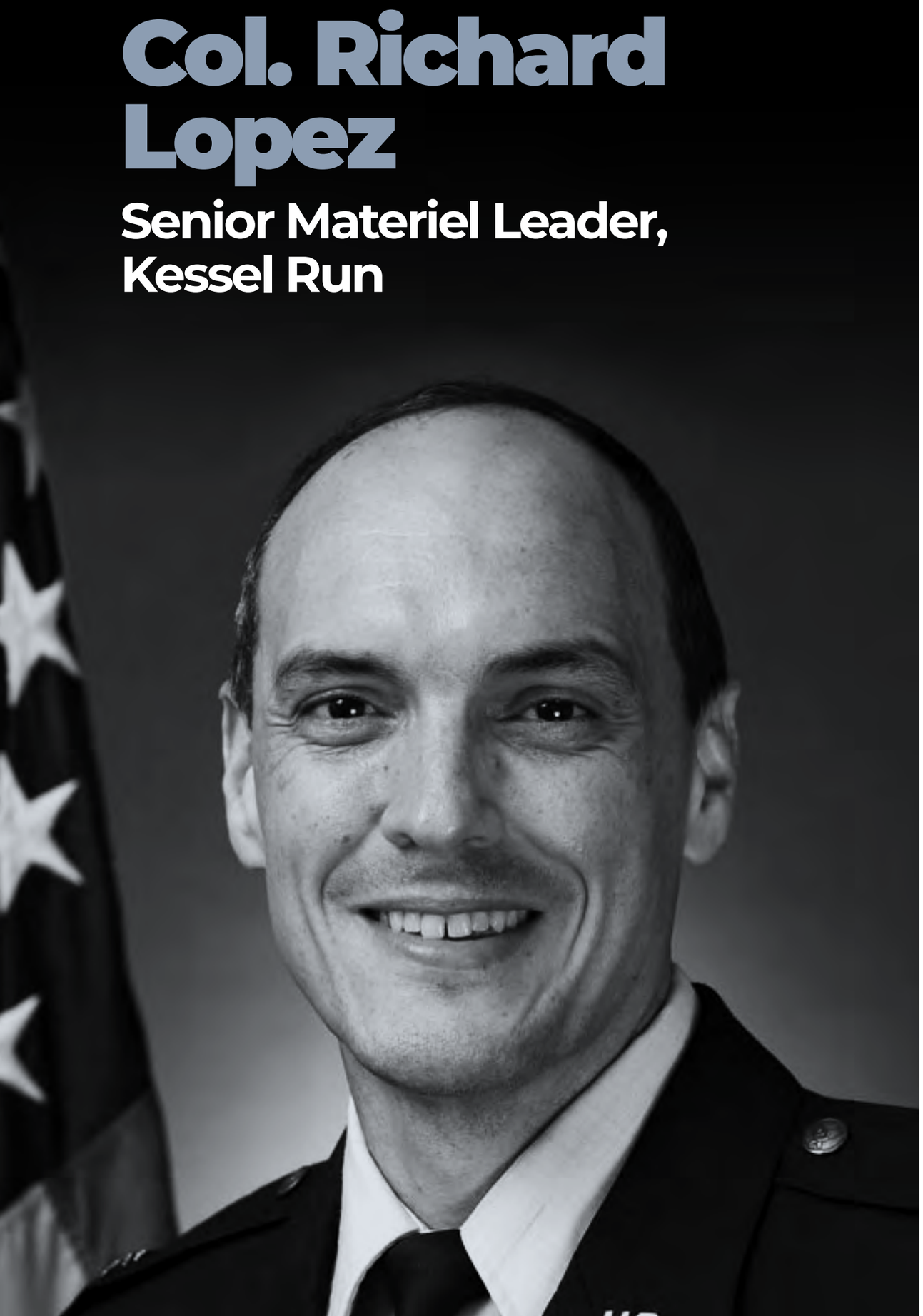
"That was a game changer in the Department of Defense. Ten years and $430 million of waste not delivering a single line of code," Sanders said. "And now we're delivering capability 4,000 times a year … code come into production is almost trivial at this point. It's a non-event."

Digital transformation starts with people, processes and technology, but flow, outcomes and feedback are the key differentiators of high-performing IT organizations. Outcomes, Sanders said, need to become a North Star by which the department measures digital transformation metrics.

"What is the difference that we're making for the citizenry or for the warfighter? Or better making use of taxpayer dollars," Sanders said.

As Lt. Col. Max Reele, who inherited Sanders' position, prepares to depart the organization, he wants to leave Kessel Run in a "healthy place."

Photo credit: Joseph Eddins / DVIDS



Reele believes digital transformation starts with processes and then moves to skills and technology.

"The real importance around process reengineering is because your stakeholders must be involved, policy must be rewritten to allow you to run continuous processes in what used to be a waterfall stochastic model," Reele said. "So if you can automate the processes and do the process reengineering as necessary to then upskill your people and then you can overlay the tech on processes that have already been optimized."

New Defense Strategies to Modernize Software

Last year, DOD released a software modernization strategy, directing the department to increase the use of software factories and secure DevSecOps pipelines.

Around the same time, DOD CIO John Sherman released a software development and open-source software memorandum, which called for an increase in the use of open-source software and commercial off-the-shelf tools whenever and wherever possible.

"Open-source software is not really a question anymore of whether it's good or bad, useful or not useful. It's a business decision about what you put into the open-source world or what you pull from, and what is the differentiating service that you're providing on top of that open-source software that makes you money," Tom Rondeau, principal director for FutureG & 5G at the Pentagon's Office of the Undersecretary of Defense for Research and Engineering, told GovCIO Media & Research.

To increase productivity, reduce costs and take advantage of products already available to the broader market, Kessel Run relies on open-source software.)

"Most software nowadays, including those that are built by us, do leverage various open-source components. It helps us stitch together our software

applications, and it gives us a lot of the productivity gains," Col. Richard Lopez, Kessel Run's senior materiel leader, told GovCIO Media & Research. "We do use open-source software when it's necessary and when we can apply it so that we deliver the best code to our warfighter."

The first thing Kessel Run does is verify whether there is a need for open-source code. Kessel Run then conducts market research to find the right code, but only DOD-approved open-source code is applied to applications built by the software factory.

But access to open source allows various bad actors to rifle through the code and exploit vulnerabilities. It can also allow malicious actors to intentionally introduce malicious code.

"The pursuit that Kessel Run has embarked on along with our stakeholder and user community is to scope down the requirements to a smaller, digestible chunk of capabilities that we can work on and then we work very hard on delivering those capabilities in smaller timeframes, which gives us the ability to quickly pivot in case the requirements change or in case the user determined that there was another better thing that they wanted us to deliver," Lopez said.

Following the overall software strategy, DOD recently released an implementation plan, which sets the department on the path to an improved software delivery process.

The implementation plan focuses on three goals: accelerating the department-wide cloud environment, increasing the adoption of a software factory ecosystem and transforming processes to allow for more successful outcomes.

"The DOD Software Modernization Strategy challenged us to be bold … to lead the transformation of technology, process and people in delivering resilient software capability at the speed of relevance. The DOD Software Modernization Implementation Plan is the follow-on call to action, aiming to establish capabilities that simplify the mechanics of software delivery, allowing teams to instead focus on creativity," according to the plan.

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