UNIVERSITY OF CENTRAL FLORIDA

ETI

NDIA

Using Data for Defense: Integrating Modeling & Simulation for Policymaking

ETI Brief Series
November 2025

Authors

Anna Kim
Associate Research Fellow, NDIA ETI

Elijah Weaver
Research Intern, NDIA ETI

Production

Zachariah Chou
Copywriter / Editor

Eve Dorris
Director, IPO

Hannah Meushaw
Creative Director

Alexander Feeser
Senior Graphic Designer

NDIA ETI Executive Director

Dr. Arun Seraphin

Acknowledgments

The authors would like to thank Dr. Arun Seraphin, Wilson Miles, Samuel Moyer, and Logan Whitehair for their editorial work; Grace Nemeroff for her research support; and Eric "Tubby" Shwedo and Dr. David Metcalf from the University of Central Florida for their partnership on this initiative.

November 2025

First published in 2025 by NDIA's affiliate, the Emerging Technologies Institute. 2101 Wilson Blvd, Suite 700, Arlington, VA 22201, United States of America. (703) 522-1820

This report is made possible by general support to NDIA and the Emerging Technologies Institute. No direct sponsorship contributed to this report. This report is produced by NDIA, a non-partisan, non-profit, educational association that has been designated by the IRS as a 501(c)(3) nonprofit organization and was founded to educate its constituencies on all aspects of national security. Its research is nonpartisan.

For more information please visit our website: EmergingTechnologiesInstitute.org

MEDIA QUERIES:
Rachel Sutherland, NDIA Director of Public Affairs & Communications at rsutherland@NDIA.org

Introduction

Currently, complex defense policy decisions are made through processes including the Planning, Programming, Budgeting & Execution (PPBE) system, Deputy's Management Action Group, and legislative activities. While these processes are central to policymaking, they often fail to leverage the full range of data and tools available to the Department of Defense (DoD). For example, DoD possesses vast, powerful modeling and simulation (M&S) tools for defense and wargaming. These capabilities, if employed effectively, could be applied to crucial areas such as organizational planning, supply chain management, or acquisition policy. Policymakers could then forecast the potential consequences of policy before implementation, avoiding unintended downstream effects. As the Pentagon looks to make significant changes to department structure and processes, there is now an opportunity to employ more advanced modeling approaches to implement new policies effectively and efficiently.

Beyond defense, M&S is widely used in commercial sectors such as healthcare, finance, and energy to optimize complex systems, mitigate risk, and maximize efficiency for policy.[1] Despite this commercial use, however, there is a lack of similar institutional support in most defense policymaking activities for modeling policies, statutes, and regulations. Bridging the gap will require collaboration between the policymaking community and the technical M&S community in order to provide clear requirements and parameters for the development and adaptation of effective tools.[2]

The National Defense Industrial Association's Emerging Technologies Institute and the University of Central Florida held an event in May 2025, titled "Navigating Uncertainty: Simulation as a Tool for Policy Innovation," to explore modeling & simulation as a tool for evaluating proposed policies and their potential outcomes. The webinar convened defense policymakers and technical M&S experts to discuss potentially fruitful applications for M&S beyond traditional wargaming, technology development, training, and systems testing to a broader set of pressing policy issues. Speakers concurred that M&S has the potential to meaningfully improve defense policymaking, noting that policymakers already use "mental models" to consider policy changes but that these are limited by experience, narrow mental data sets, and inability to represent complex systems with multiple factors.[3] They also discussed several potential use cases, such as the fiscal impact of tariffs on the defense industrial base, cybersecurity standards, and bottlenecks in government processes such as judicial review of immigration cases. The panel emphasized the need for better data quality and accessibility, methodologies for connecting problem owners with technical solution providers, and leveraging emerging technologies such as AI and digital twins to build more trusted, transparent, and comprehensive models.

1 Downie, Amanda and Finio, Matthew. "What is financial modeling?" https://www.ibm.com/think/topics/financial-modeling; COMSOL. "Modeling and Simulation Across Industries." https://www.comsol.com/industries.

2 Computational modeling refers to the use of algorithmic and numerical methods to represent physical, operational, or decision-making processes within defense systems. Predictive modeling builds on computational frameworks to forecast outcomes and behaviors under varying conditions, supporting mission planning, readiness assessment, and technology evaluation. System dynamics complements these approaches by modeling interdependent feedback loops and time-based changes within large-scale defense systems.

3 A full recording of the "Navigating Uncertainty: Simulation as a Tool for Policy Innovation" event can be found on the Emerging Technologies Institute's YouTube channel here: https://www.youtube.com/watch?v=RbyieMb9SRU&t=2s.

Current M&S Applications and Capabilities for Technology Development and Acquisition

Historically, DoD M&S activities have been channeled through numerous, shifting offices and agencies to support these efforts – for example, the Defense Modeling and Simulation Office (DMSO) was established in the 1990s, later was renamed the Modeling and Simulation Coordination Office (M&SCO), and then integrated into the Digital Engineering, Modeling and Simulation (DEM&S) initiative under the Office of the Under Secretary of Defense for Research and Engineering (OUSD(R&E)).[4] This represents only one of the broad set of M&S activities; the Army's Program Executive Office for Simulation, Training, and Instrumentation executes a multi-billion-dollar portfolio for training and testing in addition to similar activities across the DoD.[5] Examples include virtual trainers and VR/AR environments such as the Army's Synthetic Training Environment, which allow warfighters to rehearse military operations against realistic adversary models in a safe, repeatable setting;[6] naval battle network simulators that link ships, submarines, and aircraft; and Air Force advanced flight simulators and coalition virtual ranges.[7]

The Pentagon is increasingly looking to apply both physics-based modeling and data-driven modeling for critical military applications. Early initiatives to apply advanced, high-fidelity M&S as a tool for defense policy innovation are still nascent, and additional work will be needed to develop new systems or adapt existing capabilities. Fortunately, DoD and the defense industry are well-accustomed to leveraging M&S during the acquisition process, where it is used to design, test, and evaluate systems before physical prototypes are built, which helps reduce costs, timelines, and technical risks. In addition to the traditional physics-based models used in most research and engineering M&S and heavily validated through physical experiments, defense missions also employ data-driven models to support training, logistics, and joint warfighting concepts.

Some activities are already making use of data-driven methodologies. To support wargaming, the Joint Staff's Joint Innovation and Experimentation Division (J81) conducts rigorous operational-level M&S that helps inform how the Joint Force should be structured to meet current and future requirements as well as the necessary resources to address those needs. Modern logistics wargames use cloud-based simulators such as FTI's Integrated Sustainment Wargaming and Analysis Tool (ISWAT) to model global sustainment networks. ISWAT runs concurrent simulations of supply chains, including fuel, munitions, maintenance, and transport, and visualizes resource flows through real-time dashboards showing stockpiles, consumption, and logistics flows.[8] In Air Force studies, logistics simulations using ISWAT helped leaders test strategies, assess vulnerabilities, and identify chokepoints that are otherwise difficult to evaluate in live exercises.[9]

Moreover, M&S will play a central role in new acquisition activities. Previously, M&S was a key element of DARPA's Assault Breaker II (ABII) initiative, which looked to fundamentally change how the Pentagon approaches designing, buying, and fielding future systems.[10] M&S tools supported ABII by providing a complex simulation environment that allows for analyses of proposed cross-domain joint warfighting constructs. Today, Section 203 of the House Armed Services Committee's SPEED Act establishes the Mission Engineering and Integration Activity (MEIA).[11] With the creation of MEIA, the Pentagon is attempting to transform how requirements are set and validated, and M&S capabilities are intended to feed into MEIA's iterative process. The intention of MEIA is to have an office dedicated to studying new operational concepts and capabilities needed to address operational gaps of the joint force.

---

4 Office of the Under Secretary of Defense for Research and Engineering. 2023. "DoD INSTRUCTION 5000.97 DIGITAL ENGINEERING." https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodi/500097p.PDF?ver=bePIqKXaLUTK_Iu5iTNREw%3d%3d.

5 Program Executive Office Simulation, Training and Instrumentation. "PEO STRI Overview." https://www.peostri.army.mil/Who-We-Are/PEO-STRI-Overview/.

6 Marino, Cheryl. 2025. "Reality Check: Haptics Improvements to Army Simulation Training Makes Virtual Environments Feel More Realistic." Army.mil. April 1, 2025. https://www.lineofdeparture.army.mil/Journals/Army-AL-T/AL-T-Archive/Spring-2025/Reality-Check/.

7 Heckmann, Laura. 2025. "Air Force, Navy Aircraft Simulator Facility Stretching Its Wings." Ntsa.org. January 14, 2025. https://www.ntsa.org/news-and-archives/2025/1/14/air-force-navy-aircraft-simulator-facility-stretching-its-wings.

8 Ehrlich, Michael. 2024. "Beyond the Battlefield: Simulated Logistics Is Reshaping Air Force Wargaming." Ftidefense.com. December 6, 2024. https://www.ftidefense.com/news/beyond-the-battlefield-simulated-logistics-is-reshaping-air-force-wargaming.

9 Cogliano, Joe. 2018. "New Wargame Analysis Tool Will Boost Long-Term Mission Success." Wright-Patterson AFB. March 28, 2018. https://www.wpafb.af.mil/News/Article-Display/Article/1478252/new-wargame-analysis-tool-will-boost-long-term-mission-success/.

10 Defense Advanced Research Projects Agency. 2024. "Department of Defense Fiscal Year (FY) 2025 Budget Estimates." https://www.darpa.mil/sites/default/files/attachment/2024-11/u-rdte-mjb-darpa-pb-2025-06-mar-2024-final.pdf. Tompkins, Stefanie. 2022. "Accelerating Innovation for the Warfighter." https://www.armed-services.senate.gov/imo/media/doc/PASSBACK%20DARPA_%20Tompkins%20SASC-ETC%20testimony%206%20Apr%202022_DARPA_FIINAL%200031.pdf.

11 Streamlining Procurement for Effective Execution and Delivery Act of 2025. Bill (2025). https://armedservices.house.gov/uploadedfiles/speed_act_full_text.pdf.

Sample and Potential Use Cases of M&S Applications for Defense Policymaking

During the event, live lightning talk demonstrations showcased tools to help policymakers assess risks, test assumptions, and anticipate second-order effects of policy decisions; and panelists considered policymaking cases where M&S capabilities would have been particularly valuable to support decision-making processes. These sample and emerging use cases demonstrate the potential for M&S to bolster resilience in defense systems and planning.

Supply Chain Monitoring

The application of M&S to economic policy can help conceptualize how trade shifts affect demand, budgets, and global supply chains. For example, investment in the simulation of economic statecraft tools such as sanctions could one day yield predictive insight valuable to U.S. economic security and global posture.[12]

M&S tools are increasingly used to map and stress-test critical Defense Industrial Base (DIB) supply chains. As demonstrated during the webinar, private-sector analytics such as RapidRatings' Financial Health Rating (FHR) model provide forecasts of supplier solvency and risk.[13] The FHR functions as a tool that gives insight into suppliers' ability to withstand economic pressures and maintain production with minimal disruptions, enabling DoD stakeholders to anticipate shortages or cascading failures in the supplier network.

DARPA's new Resilient Supply-and-Demand Networks program has worked with Raytheon BBN in developing a global supply chain model, simulating the exact conditions of the global market and potential stressors within it.[14] The simulator combines macroeconomic network models and micro-level decision models with AI algorithms to predict the impact of shocks within the supply chain. The Defense Logistics Agency (DLA)'s platforms also use AI-enabled predictive analytics in their own operations to assess shocks and vulnerabilities in the supply chain.

NDAA and FAR Provisions

One demonstration at ETI and UCF's event, presented by the Acquisition Innovation Research Center (AIRC), showcased an emerging M&S tool for defense acquisition policymakers. AIRC's Acquisition Policy Test Lab, an "AI-based DPCAP FAR/DFARS Change Support Tool," is a prototype analytic engine to explore how changing Federal Acquisition Regulation clauses or Defense Procurement Data Analysis provisions would have downstream effects throughout programs.

While no publicly reported M&S application to the development of NDAA language is known yet, future M&S tools could help rapidly assess budget and program scenarios under different conditions. Given the wide range of important ramifications that can follow new legislation, there are a multitude of potential applications for M&S in the legislative process. Panelists noted that planning for new appropriations, or forecasting the impacts of proposed budget cuts, could be aided by digital models that simulate program budgets and force outcomes.[15] For the PPBE process, M&S could help Congress evaluate how a given set of programs of record and appropriation levels might impact a range of outcomes, such as supply chain resiliency, private capital investment in the defense industrial base, and total addressable markets for defense and dual-use companies. In terms of new authorities, M&S could assist policymakers with anticipating the likelihood that a given provision will achieve its stated goals, based on evaluations of past programs of relevance. Industry experts underscore that such efforts must tie to real policy goals, emphasizing that even the most advanced analytics "cannot deliver resilience unless they are aligned to actual policies and governance."[16]

12 Kim, Anna. 2024. "Evaluating Sanctions Through Modeling." National Defense Magazine. October 31, 2024. https://www.nationaldefensemagazine.org/articles/2024/10/31/emerging-technologies-evaluating-sanctions-through-modeling.

13 RapidRatings. 2025. "FHR Index." www.rapidratings.com. 2025. https://www.rapidratings.com/financial-health-intelligence/the-fhr.

14 Defense Advanced Research Projects Agency. "RDSN: Resilient Supply-and-Demand Networks." https://www.darpa.mil/research/programs/resilient-supply-demand.

15 Emerging Technologies Institute. "Navigating Uncertainty: Simulation as a Tool for Policy Innovation." YouTube, 30 May 2025, www.youtube.com/watch?v=RbyieMb9SRU.

16 Csànk, Trish. 2025. "Resilient Supply Chains as a Strategic Advantage | LMI." Lmisolutions.com. September 9, 2025. https://lmisolutions.com/perspectives/resilient-supply-chains-strategic-advantage.

Integration of Artificial Intelligence

Speakers from the Mixed Emerging Technology Integration Lab (METIL) at UCF's Institute for Simulation and Training highlighted that integrating AI/ML and other emerging technologies into simulation frameworks can make them smarter, trusted, and more secure for policy use.[17] DLA reports that AI-enabled models can generate and simulate complex disruption scenarios automatically, providing planners with "actionable strategies to mitigate disruptions." [18]

Digital twin technology enhances this capability by creating virtual replicas of real-world systems, both physical and virtual architectures, that continuously receive live data, allowing simulations to reflect real-time conditions and predict outcomes more accurately. Combined with AI, digital twins transform simulations into adaptive systems that learn and update dynamically. For example, this integration could allow policy analysts to test acquisition regulation changes, modeling how purchasing systems from different countries affect dollar flows or supply chains, or eventually to incorporate real-time data from across the defense industrial base and model disruptions or other scenarios. Other examples could include twinning the workforce to support modeling of personnel changes or twinning the budget to support budget priority allocation decisions made by the Pentagon and Congress. AI-enhanced M&S can shorten experimentation cycles from months to minutes, identify non-obvious dependencies, and make complex analysis accessible to non-technical decision makers.

High-Priority Challenges of M&S Integration

A recurring challenge discussed by panelists was the extensive data needs of models, which use datasets of highly varying sizes depending on the mission need.[19] However, when building models for defense applications, access to essential information can often be incomplete, classified, or face several bureaucratic barriers. As one review notes, defense supply networks are so multitiered and opaque that "primary suppliers may not have information on each of [their] third- or fourth-tier" partners, which the Government Accountability Office (GAO) notes as a significant factor in delaying model development and narrows the scope of wargames and simulations.[20] [21] In addition to access-related challenges, DoD and its partners will need to gather outcome data from past policy decisions and form relevant data sets to support the building of models for policy analysis applications.

Even with better data access, insufficient coordination between policymakers and modelers may still limit the efficacy of simulations in informing policy decisions. Without clear validation and verification, simulations can create a false sense of confidence. Former senior defense officials warn that federated simulations without common standards or oversight risk being misinterpreted.[22] As a highly nascent field, the potential for policy modeling and simulation is also relatively unknown to policymakers and officials. One webinar panelist observed that policy users often don't know what is possible, and modelers and analysts don't know what they need to address.[23] To begin to mitigate this challenge, panelists recommended workshops that would allow government employees to interface with the M&S community and cited the deployment of Advana, which included a core team of data analysis experts who engaged with interested offices and communities to demonstrate the tool's capabilities and applications, as a potential model for success.[24]

High-end simulations generate enormous amounts of data that must be distilled into intuitive dashboards or visualizations for policymakers. Translating detailed outputs into policy recommendations will require careful interface design and interpretation. Governance will be an important challenge

17 Emerging Technologies Institute. "Navigating Uncertainty: Simulation as a Tool for Policy Innovation." YouTube, 30 May 2025, www.youtube.com/watch?v=RbyieMb9SRU.

18 Roberts, Adarryl. 2025. "Utilization of Artificial Intelligence (AI) to Illuminate Supply Chain Risk." Defense Logistics Agency. May 1, 2025. https://www.dla.mil/About-DLA/News/News-Article-View/Article/4186367/utilization-of-artificial-intelligence-ai-to-illuminate-supply-chain-risk/.

19 Emerging Technologies Institute. "Navigating Uncertainty: Simulation as a Tool for Policy Innovation." YouTube, 30 May 2025, www.youtube.com/watch?v=RbyieMb9SRU.

20 Atlantic Council. 2021. "Chapter 4: Assured Supply Chains and System Resiliency." Atlantic Council. May 25, 2021. https://www.atlanticcouncil.org/content-series/geotech-commission/chapter-4/.

21 Government Accountability Office. 2023. "Defense Analysis: Additional Actions Could Enhance DOD's Wargaming Efforts | U.S. GAO." Www.gao.gov. April 24, 2023. https://www.gao.gov/products/gao-23-105351.

22 Buck, Sean. 2025. "Modeling and Simulation a Silent Engine of Military Readiness." National Defense Magazine. October 31, 2025. https://www.nationaldefensemagazine.org/articles/2025/10/31/ndia-perspective-modeling-and-simulation-a-silent-engine-of-military-readiness.

23 Emerging Technologies Institute. "Navigating Uncertainty: Simulation as a Tool for Policy Innovation." YouTube, 30 May 2025, www.youtube.com/watch?v=RbyieMb9SRU.

24 Ibid.

to address during integration, especially when determining roles, responsibilities, and organizational structure between offices for policy-oriented simulations. GAO has noted that even in wargaming, a more developed area of modeling, the lack of a centralized calendar or lead organization limits coordination and innovation. Additionally, even with the provision of intuitive dashboards, it will be valuable to recruit and develop a data-literate workforce capable of engaging with more advanced analytics.

Conclusion

Modeling and simulation is an indispensable tool for military readiness, yet its potential to transform defense policymaking remains unrealized. As the Department of Defense continues to modernize and seeks to build more effective and efficient policy, integrating advanced analytical frameworks and simulation capabilities into policy design becomes increasingly important in creating more adaptive, empirical decision processes. By using tools such as AI-enhanced modeling, policy-specific test ranges, and system dynamics, policymakers can forecast the potential outcomes of complex choices before implementation and therefore mitigate unintended consequences.

Building institutional trust, improving data pipelines, and developing governance structures that promote the sustained use of modeling and simulation in policymaking are essential steps for innovation in this field. When fully integrated, M&S can evolve beyond its role in wargaming and training to become a central tool for policy innovation.

ETI EMERGING TECHNOLOGIES INSTITUTE | NDIA

Supporting Emerging Technologies To Secure U.S. National Defense and Advance U.S. Economic Strength

The National Defense Industrial Association's Emerging Technologies Institute (ETI) performs research, hosts events, and bolsters public awareness through educational products and webinars focused on defense technology modernization and innovation. ETI also works to create a policy environment most conducive to the efficient development and delivery of new systems and technologies for the defense enterprise. ETI engages industry, academia, policymakers, and the public to explore emerging technologies' impact on national security and opportunities for industry-government partnerships to increase U.S. competitive advantage.

ETI reports, events, and workshops support NDIA's membership and the defense science & technology enterprise as part of its nonpartisan 501(c)(3) mission.

ETI was founded in 2021 and is staffed by researchers and subject matter experts and backed by a preeminent advisory board.

For more information, visit **EmergingTechnologiesInstitute.org**

ETI EMERGING TECHNOLOGIES INSTITUTE
EmergingTechnologiesInstitute.org