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Connecting the Kill Chain to the Supply Chain: Building Industrial Surge Capacity

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Connecting the Kill Chain to the Supply Chain: Building Industrial Surge Capacity

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Abstract

U.S. industrial might, once a decisive deterrent in the post–World War II era, has significantly eroded. Consolidation of the defense industrial base, offshoring of commercial manufacturing, and brittle just-in time supply chains have hollowed out our ability to deter or defeat peer adversaries. This research builds on scenario planning performed by the National Defense Industrial Association (NDIA) Surge Capacity working group. It develops a framework for actions and investments during peacetime for an industrial mobilization capability—one that is prudent to plan and hopefully never needed. The research examines quantification of demands for ordnance, spares and maintenance at combat utilization rates; resource strategies for building the needed industrial capacity for a prolonged conflict; acquisition strategies for pre-planned surge capacity; sustainment actions to maintain supply chain visibility; transition strategies that re-create an industrial mobilization board; and rapid response adaptation strategies for combat contingencies. A targeted literature review evaluates prior planning efforts, organizations and models dating back to the Cold War. The framework proposes courses of action suited to today's defense and commercial industrial base (including allies).

Introduction

The Department of War (DoW) Acquisition Transformation Strategy seeks to "Put the entire acquisition system and the industrial base on a wartime footing" (DoW, 2025a). As this strategy is implemented, the Department will be increasingly prepared to respond to the demands of a short, intense conflict with a peer adversary. Efforts are underway to rapidly rebuild the inventory of munitions needed for such a conflict. But more needs to be done to prepare for the possibility of a prolonged war. Today's Defense budget is around 3.5% of Gross Domestic Product (GDP) compared to 40% of GDP during WWII (Figure 1). Ukraine in 2024 spent 34% of GDP on defense (Tian et al., 2024). We are far from being in a wartime economy and hope to remain so. It is prudent, however, to plan now for an industrial mobilization we hope never to need.

Figure 1. U.S. Defense Spending as % of GDP
(Federal Reserve Bank of Saint Louis [FRED], 2026; O'Hanlon, 2024; Stockholm International Peace Research Institute, 2025)

This paper is based on the work of the National Defense Industrial Association (NDIA) Ad Hoc Working Group on Industrial Surge Capacity. That group examined unclassified scenarios in a contested logistics environment to demonstrate simulation-based methods to quantify replenishment demand profiles beyond the initial 60 days (NDIA Manufacturing Division, 2025). In the next section of this paper, industrial mobilization approaches dating from World War I are reviewed. The third section examines scenario planning and presents a methodology for quantifying demand profiles for different commodity classes. In the fourth section, the DoW Acquisition Transformation Strategy and Defense Industrial Base (DIB) ecosystem are reviewed as the key enablers for acquisition improvements that are vital for industrial surge and the foundation for pre-planning industrial mobilization. The final section develops a playbook with pre-planned actions (herein called "switches") for realizing rapid industrial mobilization and offers recommendations for near-term action and longer-term research and development.

Background on U.S. Industrial Mobilization Planning

The historical context for modern U.S. industrial mobilization starts with preparation for World War I. As described by McGinn (2020), in the early 1900s, the U.S. industrial base was focused entirely on commercial manufacturing, except for a limited number of arsenals and shipyards. Unlike European nations, where military planners mobilized industrial production of war materiel in anticipation of the coming conflict, the United States entered the war in 1917 largely unprepared. The War Industries Board (WIB) was created as an emergency agency staffed by industry executives on loan from their companies to oversee war production. The emergency mobilization built enough cargo ships, rifles, trucks and aircraft to support the deployment within 2 years. Most of this materiel arrived too late to equip the 2 million U.S. troops, who fought using heavy equipment from European allies. The WIB was dismantled in 1919, but the importance of U.S. industrial might and the lessons of mobilization planning had been learned.

During the 1930s, President Roosevelt saw the growing need for industrial preparedness. Congress passed the Fleet Expansion Act (Naval Act of 1938) to authorize a 20% increase in U.S. Navy strength and procurement of 3,000 aircraft, moving the Navy toward a two-ocean fleet. In 1940, President Roosevelt asked Congress initially for $2 billion for defense, followed in May by a request for another $2.4 billion, and then in July for an additional $4.8 billion

> To procure reserve stocks of tanks, guns, artillery, ammunition, etc., for ... a total of 2,000,000 men if a mobilization of such a force should become necessary. To provide for manufacturing facilities, public and private, necessary to produce critical items of equipment for a land force of 2,000,000 men, and to produce the ordnance items required for the aircraft program of the Army and Navy—guns, bombs, armor, bombsights and ammunition. Procurement of 15,000 additional planes for the Army and 4,000 for the Navy, complete with necessary spare engines, armaments, and the most modern equipment. (Roosevelt, 1940)

This was the basis for the "Great Arsenal of Democracy" discussed in Roosevelt's December 1940 famous fireside chat.

The WWII whole-of-economy mobilization became the benchmark for wartime industrial planning. Leaders of industry, such as Bill Knudsen of General Motors and Henry Kaiser, a construction and shipbuilding magnate, were instrumental in establishing or converting to wartime production industrial capacity in steel, ships, tanks, aircraft, and all the materials needed for war. The Government brought in industry to help with the War Production Board, the Office of Production Management, the Supply Priorities and Allocation Board, and others. The Automotive Council for War Production (ACWP) and other industry groups pooled resources, tools and technical knowledge to increase efficiency, enabling mass production of B-24 bombers. To illustrate the magnitude of the transition to wartime production, there were about 3 million automobiles manufactured in the United States in 1941. During the entire war, only 139 additional cars rolled off the assembly lines. Instead, automakers built guns, trucks, tanks and aircraft engines. The Lionel toy train company started producing items for warships, including compasses. Alcoa, the aluminum company, produced airplanes. The Mattatuck Manufacturing Company, which had made upholstery nails, switched to making cartridge clips for Springfield rifles. Shipyards turned out entire fleets of aircraft carriers, battleships, destroyers, submarines and other vessels (Vergun, 2020). These efforts resulted in an unprecedented increase in production, with U.S. factories producing more than the combined output of all Axis powers by 1944.

In 1950, Congress enacted the Defense Production Act (DPA), which remains an important tool today for industrial preparedness. DPA Title I: Priorities & Allocations allows the government to "jump the line." Agencies can require companies to prioritize government contracts over private ones. Title III: Expansion of Capacity provides financial incentives (loans, grants, or purchase commitments) to help private companies expand production. Title VII: General Provisions grants the government power to block foreign mergers that threaten national security and establishes "Voluntary Agreements" with industry. While Title VII is routinely used by the Committee on Foreign Investment in the United States (CFIUS), Voluntary Agreements have fallen into disuse and may become important in planning for future industrial mobilization (McGinn, 2025).

In recent years, the DPA authorities were used to enable the U.S. response to COVID-19, called Operation Warp Speed (OWS). The DPA allowed the U.S. government to accelerate vaccine development from the typical 10-year timeline down to less than 1 year. Rather than the government simply buying finished products, the DPA allowed officials to assert priority and manage the entire supply chain. As part of OWS, the Department of Defense (DOD) used Other

Transaction Authority (OTA) consortia as the primary legal and administrative vehicle to move billions of dollars to pharmaceutical companies at a speed that traditional federal contracting could not match. In essence, the DPA was the basis for expanding manufacturing and the OTA consortia were the fast-track lane for the money and legal agreements.

A comprehensive CSIS assessment identified several enduring insights from the history of industrial mobilization (Cancian et al., 2020). Among the most significant: Mobilization takes years and constantly finds itself behind the pace of demand; there is a persistent need for centralized economic planning to cope with the massive dislocations that arise; production must be balanced across supporting capabilities as well as major end items; and there is critical value in beginning industrial mobilization before conflict begins. There is also an inherent tension between efficient peacetime production and maintaining capacity for wartime surge, a tension that must be resolved through deliberate planning rather than ad hoc responses. These historical and contemporary realities provide the motivation for the mobilization framework developed in the following sections of this paper.

Scenario Planning and Quantifying Demand

The NDIA Industrial Surge Working Group's Scenario Planning effort uses realistic, unclassified narratives (such as F-35 component failures, contested logistics, and affordable-mass drone deployments) to run iterative wargames and high-fidelity simulations with a wide range of defense, industry, and academic stakeholders, while calling for a parallel classified scenario set to capture detailed threat effects. Quantifying Demand focuses on the overwhelming wartime need for long-range munitions and accelerated spare part consumption, employing discrete event simulation and wargaming informed hybrid methods to produce time phased, mission coupled demand profiles. These profiles identify peak consumption periods and the specific "switches" that trigger surge contracts, tooling expansion, and workforce mobilization. Together, the two sections provide the analytical foundation for a preemptive "break glass" surge plan that aligns industrial capacity with dynamic logistics demands in high intensity conflict.

Scenario Planning

Since its inception, the NDIA Industrial Surge Working Group has used realistic, fictional, and unclassified scenarios as a way to support the development of a surge framework and "kill-chain-to-supply-chain" playbook. By deliberately keeping the scenarios unclassified, the group was able to involve a broad spectrum of stakeholders, test innovative tools (such as the USAF Deployment Readiness Tool [Crowley, 2022]) and generate actionable recommendations.

The Working Group blended iterative wargaming and simulation, subject-matter-expert validation and cross-community engagement in a series of multi-day workshops. Workshop participants included representatives from the Office of the Under Secretary of Defense for Acquisition & Sustainment, DARPA, the Air Force Research Laboratory, the Manufacturing Innovation Institutes, leading defense OEMs, and lower-tier suppliers. Simulation iterations were performed by Georgia Tech to model demand signals, failure modes, and logistics bottlenecks, allowing participants to receive rapid feedback on how changes in the kill chain ripple through the logistical supply chain and industrial base.

Three scenarios were co-developed with Tim Zadalis (Major General, USAF, Ret.) and examined in this series of workshops:

- <u>F-35 Critical Components</u> – Considered battle damage to a structural wing spar, failure of an electronic stabilizer control, and a post mission recovery decision that diverts the aircraft to a maintenance hub based on real time health data. Highlighted how digital twins might be used to generate demand spikes for specific high value parts, enabling the "switch on" of surge contracts for rapid response/retooling of supplier lines.

- Contested Logistics – Integrated model of Agile Combat Employment sorties supported by Air Mobility Command (AMC) airlift and Air Combat Command (ACC) kinetic missions, with a joint all domain command and control overlay that prioritizes combat sortie generation and how it influenced the supply chain and sustainment. Highlighted the interdependence of airlift and kinetic sortie rates, quantifying the "logistics-to-kill-chain" coupling that the surge playbook must address (e.g., surge capacity for rapid depot level repairs of subsystem and Line Replaceable Unit [LRU] components).

- Affordable Mass – Carrier-based deployment of attritable kinetic kill drones for area defense and Collaborative Combat Aircraft (CCA) formations of enhanced F 35/F 22 platforms executing high tempo sortie cycles. Provided context for evaluating low cost, high volume production pathways and the scalability of "affordable mass" surge lines that complement traditional high value platforms.

While these scenarios generated insights in an unclassified setting, classified scenarios that the DoW can share with cleared industry in an appropriate setting are now needed. These would allow inclusion of granular threat modeling (e.g., sensor, electronic-warfare, and cyber-attack effects) that directly impact failure rates and logistics node survivability; that otherwise cannot be considered and addressed in an unclassified environment, e.g., access to DoW-level demand forecasts, contract award data, and classified inventory positions, which are essential for calibrating "surge readiness level" metrics, and operational lessons learned from past DoW engagements and exercises. Future work should therefore establish a classified scenario-working group that mirrors the unclassified structure (with government lead, industry partners, and academic analysts) while operating under appropriate DoW security controls. The Space Force is already pursuing direct industry collaboration through a series of classified wargaming activities (Albon, 2026). The output will be a set of "protected" scenario packages that could leverage a classified simulation environment, allowing the unclassified surge framework and playbook to be stress-tested against realistic adversary actions and to refine the decision-point "switches" that trigger surge contracts, expanded workforce mobilization, and rapid tooling acquisition.

Quantifying Demand

The most significant demand on the defense industrial base in a major war would likely come from munitions expenditures and the wear and tear of weapons systems and equipment (Jones, 2023). Analyses of high-intensity conflict scenarios consistently demonstrate that current stockpiles are insufficient (Gunziger, 2021; Jones, 2023). The CSIS wargame, which modeled a 2026 invasion scenario across 24 iterations using analytically based rules grounded in historical data and operations research, consistently surfaced the centrality of long-range precision munitions to the defense of Taiwan (Cancian et al., 2023; Cancian et al., 2020).

Lead times compound the problem. Missiles such as the PAC-2/PAC-3, Tomahawk Block V, JASSM, and Precision Strike Missile take about 2 years just to get first units off the line (Jones, 2023). The DoW Munitions Acceleration Council (DoW, 2026) aims to at least triple production capacity for critical munitions through multi-year contracts, but even with acceleration, restocking at wartime consumption rates will take years.

The challenge extends beyond munitions to spare parts and sustainment materiel. In high-tempo operations, aircraft and vehicles experience accelerated wear, driving demand for line replaceable units, structural components, and consumables at rates far exceeding peacetime planning assumptions. Initial stocks of spares and consumables will need to be replenished during any extended combat, likely exceeding the capacity of peacetime supply chains.

Effective industrial surge planning requires more than aggregate estimates of materiel requirements. In high-intensity conflict against a peer adversary, demand is *time-phased* and *operationally coupled*: What matters is the shape of consumption over days and weeks and how that consumption propagates through maintenance pipelines, transportation networks, and inventory positions to influence the number of missions that can actually be executed. In other words, it is essential to recognize the operational dynamics and how materiel eventually translates into combat power/ability to fight. In essence, the supply chain is the kill chain.

The importance of this coupling between operational outcomes and industrial planning is amplified by the realities of contested logistics. Despite decades of analysis, logistics remains strategically decisive but rarely given equal footing with fires, maneuver, or command and control (Welch, 2026). Quantifying wartime demand requires methodological tools that can capture the complexity of operational consumption patterns and their interaction with logistics and supply chain constraints. Existing approaches span a range of fidelity and analytical focus:

- <u>Static requirements estimation</u>***.*** The most basic approach involves calculating aggregate materiel requirements based on assumed operational tempos and historical consumption rates. While straightforward, this method treats demand as a fixed quantity and does not capture the dynamic interaction between consumption, resupply, and operational outcomes.

- <u>Scenario-based operations research.</u> More sophisticated approaches embed demand estimation within operational scenarios that model force employment, attrition, and logistics constraints. The CSIS wargame of a Chinese invasion of Taiwan exemplifies this approach, combining historical analogies (e.g., amphibious lift rates derived from Normandy, Okinawa, and the Falklands) with theoretical weapons performance data to adjudicate combat outcomes across 24 iterations (Cancian et al., 2023).

- <u>Discrete event simulation.</u> Discrete event simulation (DES) offers the highest fidelity for modeling time-phased demand because it can represent individual events—sorties flown, weapons expended, components failed, repairs completed, parts requisitioned—as they occur in sequence over simulated time. The DRT Tech Contested Logistics Operations Under Digital Support (CLOUDS) solution, employed in NDIA Working Group workshops, uses this approach to model demand signals, failure modes, and logistics bottlenecks in contested environments (Cantrell et al., 2025), allowing participants to observe how changes in the kill chain ripple through the logistical supply chain and into the industrial base (NDIA Manufacturing Division, 2025). Similarly, the U.S. Air Force–funded Deployment Readiness Tool (DRT) uses component reliability assessments to quantify spare parts demand under operational scenarios.

- <u>Wargaming-informed hybrid approaches</u>***.*** A promising direction combines the strategic breadth of wargaming with the analytical precision of simulation. In this approach, wargame outcomes, e.g., force dispositions, attrition rates, operational tempos, serve as inputs to detailed simulation models that generate time-phased demand profiles for specific commodity classes. This hybrid methodology preserves the operational realism and expert judgment that wargames contribute while adding the quantitative rigor needed to translate operational outcomes into industrial planning signals.

The NDIA Industrial Surge Working Group developed a methodology that operationalizes the time-phased, mission-coupled demand concept through a structured, multi-step process. First, the operational scenario defines the mission profile: platform types, sortie rates, threat environment, and expected engagement patterns. Second, the scenario is instantiated in a discrete event simulation that models weapon expenditures, component failures, battle damage, and maintenance actions at the individual-event level over the full duration of the conflict. Third, the simulation generates time-phased demand profiles for multiple commodity classes, e.g., munitions (by type), spare parts (by system and line replaceable unit), consumables, and repair materials. These profiles capture not only the aggregate quantity demanded but the temporal distribution of that demand: peak consumption periods, sustained burn rates, and the interaction between munitions expenditure and maintenance-driven demand. Fourth, the demand profiles are compared against current production rates and inventory positions to identify the magnitude and timing of surge requirements. The gap between projected demand and baseline capacity defines the industrial response needed and the pre-planned "switches" that must be activated at the onset of conflict.

The United States cannot afford to wait until a conflict begins to determine how the defense industrial base should respond. Jones (2023) argued that the DoD, in coordination with Congress, should develop a plan that pre-positions the policy, contractual, and regulatory steps needed to streamline production, acquisition, replenishment, foreign military sales, and ITAR processes in an emergency wartime situation. The demand quantification methodology described above provides the analytical foundation for such a plan by identifying, in advance, the specific commodity classes, quantities, and timelines that drive the most critical surge requirements.

Finally, over 100 logistics-focused wargames and exercises since 2019 have consistently exposed the same contested-logistics vulnerabilities, i.e., findings that are by now well established. Yet these insights have not been translated into revised planning assumptions, force design changes, or binding resource decisions. The gap is not analytical but institutional: There is no mechanism to connect what wargames reveal to what programs fund and commanders execute. Closing that gap requires a decision-support ecosystem in which operationally relevant data, e.g., demand profiles, supply chain capacity, inventory positions, and throughput constraints, is continuously available, authoritative, and linked to the governance structures that allocate resources. Without that connective tissue, wargame findings will continue to accumulate without leading to positive outcomes.

A Playbook for Industrial Surge

Translating these insights into an actionable playbook requires addressing three enabling conditions. First, contracting mechanisms must be in place before conflict begins. The DoW Acquisition Transformation Strategy paves the way for this. Second, workforce readiness is a binding constraint. Realistically, mobilization needs to tap the capacity of the U.S. commercial production base to meet production manpower needs. Third, supply chain visibility must extend deep into the defense and commercial (and allied) sub-tier base to identify capabilities and capacity that can avert wartime bottlenecks.

The DoW Acquisition Transformation Strategy Provides a Foundation

The DoW Acquisition Transformation Strategy addresses long-standing shortcomings in the interface between the DoW and the industrial base. Its five "pillars" not only transform the acquisition process to a new emphasis on speed and warfighting capability but also provide a new ecosystem that can enable rapid transition to industrial mobilization if needed. The five pillars and the sub-elements most relevant for surge capacity planning are:

1. Fuel the Arsenal of Freedom: Rebuild the Defense Industrial Base
    - Expand the Industrial Base, Stabilize Demand Signals, Accelerate Private Capital Investment
    - Accelerate Commercial Preference, Procure Industry-Driven Solutions, Information Technology Acquisition
    - Establish the Industrial Base Consortium
2. Elevate and Empower the Acquisition Workforce to Rapidly Deliver Capability
    - Portfolio Acquisition Executives, Capability Portfolio Management, Capability Trade Councils
    - Accelerate Planning, Programming, Budgeting, and Execution (PPBE) Reform
3. Maximize Acquisition Flexibility through Reduced Regulations and Processes
    - Digitize Acquisition
    - Modernize Test Infrastructure, Reduce Test Oversight
    - Common-Sense Accounting, Federal Acquisition Regulation (FAR) and Defense Federal Acquisition Regulation Supplement (DFARS) Reduction, Foreign Military Sales (FMS) Reform
4. Develop High Performance Systems through Rigorous Enterprise Technical and Execution Excellence
    - Wartime Production Unit
    - Open Systems Architectures, Rapidly Generate New Kill Chains
5. Improve Effective Lifecycle Risk Management
    - Government Weapons Repair and Maintenance
    - Fixing the Broken Supply Chain

Each pillar includes multiple lines of effort and aggressive timelines for implementation. There are gaps—additional actions needed to prepare for an extended conflict requiring mobilization—but the starting point has been well articulated.

For example, in the first pillar, peacetime stabilized demand signals may suffice to stimulate private capital investment, but additional pre-arrangements are needed for government and industry investment in the capacity to meet wartime demands. The emphasis on commercial preference and industry-driven solutions will expand peacetime relationships with commercial firms whose capacity can be rapidly switched to defense production in time of war. The Industrial Base Consortium (part of Pillar 1) includes many non-traditional defense suppliers and thus can provide the DoW with insight into where capabilities and capacity for wartime exist in the industrial base.

Similarly, in Pillar 2, the focus on portfolio capability acquisition, management and trade space coupled with budget flexibility will transform peacetime response times in ways that can enable rapid wartime response. Again, additional steps are needed to pre-plan expanded capacity for replenishment of key warfighting capabilities.

In Pillar 3, digitizing acquisition can greatly increase speed of response, as discussed in the next section of this paper. Reforming Federal acquisition regulations and accounting requirements will address many of the long-standing barriers to integration of military and commercial manufacturing. Additionally, modernizing test and evaluation and reforming accounting and acquisition regulations are essential to attracting commercial suppliers to government business.

Pillar 4 establishes the Wartime Production Unit (WPU), with the mission to transition the U.S. industrial base from a lean, "just-in-time" peacetime model to a "just-in-case" wartime footing capable of rapid surge and sustained high-intensity output. This is a key element of the strategy to prepare for industrial mobilization. The WPU uses a dedicated team of venture capital-style negotiators and manufacturing experts to negotiate multi-year deals with private companies to invest in capabilities and capacity needed in wartime. These deals are executed in close partnership with the DoW Economic Defense Unit (EDU)'s authorities for loans, grants and purchase commitments that incentivize private capital investments. Under the Arsenal of Freedom Framework, the WPU can license designs to multiple secondary manufacturers to ensure that if one factory is compromised or delayed, others can respond. Pillar 4 also emphasizes the use of modular open system architecture to increase the resilience of sources of supply and to provide for rapid upgrades in response to changing battlespace needs.

Pillar 5 addresses the need for technical data for weapon repair and maintenance. During acquisition, the DoW needs to balance industry intellectual property rights with government needs for depot repairs and competitive spare parts production. Historically, data delivered to the government has rapidly become outdated. New approaches such as Technical Data as a Service (Thompson & McGrath, 2019) offer ways to ensure digital data is up to date. Pillar 5 also addresses the need for supply chain visibility. Rather than a snapshot in time, the DoW will need to maintain visibility of the supply chain as it evolves over the lifecycle and continually mitigate supply chain risks.

In all of these pillars, the emphasis on commercial practices is vital to planning for large scale industrial mobilization. U.S. and allied commercial industries operate at a scale orders of magnitude larger than DoW peacetime demands. These industries are capable of delivering military products from commercial lines. This was demonstrated in an Air Force manufacturing technology program that used a commercial automotive production line to produce and qualify a circuit card for the F-22 aircraft (Air Force Research Laboratory, n.d.). The supplier, TRW, reported that the entire lifecycle requirement for this product, including production installs and lifetime spares, could be met by two shifts in their production plant. Wartime surge production will need to harness this commercial capacity. The National Academies report on Integrating Commercial and Military Manufacturing (National Research Council, 2002) provides additional examples and identifies barriers. Most of those barriers are now addressed by the Acquisition Transformation Strategy.

The Ecosystem: Effectiveness and Productivity Enhancers

Through the DoW Acquisition Transformation Strategy, Government and Industry have begun to operationalize the ecosystem that will tap commercial production and manpower and provide digital transformation capabilities to reduce response times. Collaboration across an ecosystem of Government, Industry and Academic partners requires four key ecosystem elements to operate in concert with one another, as shown in Table 1.

The first element, Strategic Governance, establishes clear authority, defines surge-readiness metrics, establishes the needed Government and Industry partnership structure, and authorizes "switch-on" contracting mechanisms for rapid scale-up across the broader Industrial Base to include commercial/non-traditional defense companies. The Acquisition Transformation Strategy will provide solutions to address previous blockers, including:

- **Strategic Direction** – This includes the establishment of new governance bodies to drive more Government and Industry collaboration, including Business Operators for National Defense (BOND; Todd Lopez, 2026), Office of Industrial Base Policy (IBP) who help shape policy for streamlining acquisition, a Wartime Production Unit for accelerated munition production, and an Economic Defense Unit which acts as a financial accelerator for the defense industrial base (DoW, 2025c).
- **Organizational Execution** – The Strategy establishes new Portfolio Acquisition Executives (PAEs) as empowered, single-point accountability leaders responsible for consolidating and managing related weapon programs and the use of Adaptive Acquisition Framework Pathways that replace the old "one-size-fits-all" model.
- **Policy/Funding –** The Strategy leverages authorities and funding like those from the Defense Production Act (DPA), the newly established Joint Acceleration Reserve (JAR) (DoW, 2025b), and the Office of Strategic Capital (OSC) that give the ecosystem the legal and financial agility required to translate a real-time battlefield demand or sortie-mix change into an actionable procurement trigger.

Table 1. Ecosystem Elements

Ecosystem Element	**Core Role in the Kill-Chain → Supply-Chain Loop**	**DoW Acquisition Transformation Strategy Pillars Supported**
Strategic Governance	Sets authority, defines surge-readiness metrics, creates partnership structures (e.g., BOND, IMB, WPU, EDU) and authorizes "switch-on" contracts that turn battlefield demand into procurement actions.	• Rebuild the Arsenal of Freedom • Maximize Acquisition Flexibility • Elevate and Empower the Acquisition Workforce (through policy & funding levers)
Digital Infrastructure	Provides a secure, federated data spine (TDaaS, software and data repositories, zero-trust APIs) that makes battlefield demand and supply-chain capacity machine-readable, continuously available, and protected.	• Develop High-Performance Systems (model-based engineering, rapid data-driven decisions) • Improve Lifecycle Risk Management (real-time risk analytics) • Maximize Acquisition Flexibility (enables agile contracting)
Industrial Base	Converts scientific discoveries into producible parts, maintains validated digital twins, supplies process knowledge and a trained workforce, and expands capacity through OEMs, MIIs, Tier-2/3 suppliers, universities, and labs.	• Rebuild the Arsenal of Freedom (surge-ready industrial base) • Elevate and Empower the Acquisition Workforce (training, up-skilling) • Develop High-Performance Systems (advanced-manufacturing, innovative materials)
Operational Users	Generates real-time kill-chain demand (damage reports, sortie-mix changes) via warfighters, JADC2 nodes, and forward logistics; consumes delivered materiel and feeds feedback to the digital spine.	• Maximize Acquisition Flexibility (rapid demand-driven contract triggers) • Improve Lifecycle Risk Management (continuous feedback loop) • Elevate and Empower the Acquisition Workforce (hands-on operational insight)

The second element, Digital Infrastructure, embodies the DoW Digital Standards Strategy (Defense Standardization Program Office, 2026) definition of “a foundational architecture supporting the software tools, training, communication, and interoperability required to facilitate the exchange of real-time data across multiple platforms, organizations, and partners while maintaining strict access controls and cybersecurity.” To respond, the United States must realize an infrastructure that enables us to leverage all four Ecosystem Elements. Such an infrastructure must host a secure, federated data spine (e.g., software and data repositories, Technical-Data-as-a-Service [TDaaS], and zero-trust API gateways [National Security Agency, 2026], all in a secure, collaborative digital ecosystem) through which battlefield telemetry, requirement updates, and supply-chain capacity data become machine-readable, continuously available, and protected by strict access controls. This digital backbone can deliver the real-time demand signals the acquisition transformation pillars require, enable model-based engineering, and allow risk-based decision making across the entire product lifecycle at the speed of warfighter need.

The third element, Industrial Base (including academia), supplies the technical substance, workforce development, and private capital elements of the ecosystem. Systems Integrators, Original Equipment Manufacturers (OEMs), Manufacturing Innovation Institutes, mid-tier (Tier 2/3) suppliers, Universities, and National Laboratories convert scientific discoveries and technical innovations into manufacturable parts, maintain verified digital models and data for decision making, and populate the data lake with process knowledge, tooling footprints, and workforce competencies needed to realize the U.S. DoW vision. Furthermore, for the Industrial Base to be an effective deterrent, it must extend beyond conventional defense contractors to pre-plan and incentivize participation by non-traditional, commercial companies—a big area of emphasis in the Acquisition Transformation Strategy. Seth Jones (2025) underscores the importance of better leveraging the nation’s commercial sector not only to take advantage of technical advancements outside of defense, but also to extend capacity through small and medium size manufacturers. By integrating additional capabilities and capacity from the broader industry into a shared digital environment, the ecosystem fulfills the transformation goals of accelerating workforce up-skilling, expanding surge-capacity, and ensuring that high-performance systems can be prototyped, qualified, and fielded at the speed of relevance.

Finally, and most critical to ensuring clear articulation of demand from the battlefront, the ecosystem also must include the Operational Users themselves, including the warfighters, Joint All-Domain Command and Control (JADC2) nodes, and forward logistics operators. They provide the originating “kill-chain” inputs, consume the resulting materiel and capability produced by the Industrial Base to execute their mission and deliver battlefield effects. Shah and Kirchhoff (2024) highlight the importance of collaboration between military end-users and Industry developers from the earliest stages of development to iterate technology rapidly based on real-world feedback. Operational users’ real-time demand, damage reports, and logistics status close the feedback loop, supplying the data that drives the digital infrastructure and informs strategic governance decisions. When operational users can instantly query the collaborative digital ecosystem for part availability, supply chain surge-readiness levels, and delivery timelines, the acquisition transformation’s objectives of rapid flexibility and improved risk management become tangible.

To be prepared for a long duration conflict with a peer adversary, the ecosystem must evolve from a narrowly focused, short term surge model to an enabler of wartime mobilization. That evolution requires: 1) expanding the industrial base to include commercial and nontraditional defense firms across the continental United States and in allied partner nations; 2) integrating these partners into a secure, standards based digital infrastructure that can convey real-time kill chain signals as actionable supply chain orders; and 3) embedding “switches” (e.g., preapproved surge readiness metrics, flexible funding authorities, and automated contract triggers) into the strategic governance framework of a secure and collaborative ecosystem. Only by deliberately and proactively identifying the actions needed for gap closure in each of the four ecosystem elements can the DoW and Industrial Base at large be ready to scale defense production to the 35–40% GDP range required for a full wartime economy.

Multiple recent workshops across the Aerospace and Defense Industry have shown that the creation of a Collaborative Open Digital Ecosystem (CODE) presents a unique opportunity for the DoW to fuse collaborative partnerships with a federated digital infrastructure, delivering a capability that can securely and directly link the kill chain to the supply chain at a tempo demanded by the modern warfare (American Institute for Aeronautics & Astronautics [AIAA] & NDIA, 2026). By securely linking battlefield capability demand data to a trusted network of government, industry, academia, and allied partners, CODE enables transformation of isolated acquisition silos into a dynamic, integrated “network of networks” required for realizing the U.S. DoW Warfighting Acquisition System (WAS). This collaborative ecosystem could provide the essential conduit through which rapid, data-driven decisions can be made, enabling surge production, logistics, and sustainment to be executed with the speed and scale of modern contested operations.

An integrated digital infrastructure provides the foundation for realization of this vision. Establishing a federated Technical Data as a Service (TDaaS) platform enables the ingestion and normalization of operational demand signals from Joint All Domain Command and Control (JADC2), translates a kill chain event (e.g., a damaged wing spar or a sortie mix shift) into an instantly observable surge request, and broadcasts it to authorized suppliers and surge ready facilities. Simultaneously, the same infrastructure delivers a real time view of supply chain capacity, tooling availability, and workforce readiness to acquisition officials and systems integrators. This bidirectional transparency allows the industrial base to size production lines, preposition tooling, and allocate skilled labor before a crisis escalates, thereby helping close the latency loop that hampers rapid fielding.

Realizing this vision, however, requires closing several critical gaps. First, a coherent data strategy to make data machine readable and machine interpretable is only partially defined and implemented, limiting seamless exchange across domains and ecosystem partners. Second, tool integration is fragmented with proprietary engineering suites and disparate versioning which hinders the rapid sharing of data, models, simulations and process workflows. Third, the overarching architecture lacks a universally adopted open standards framework, resulting in multiple reference models that impede cross program interoperability. Finally, trust in the underlying models (ensured through provenance metadata, continuous verification, and role-based access controls) has not yet been institutionalized across the broader ecosystem. Addressing these gaps through collaborative development of Government and Industry roadmaps, joint standards committees, and sustained investment in workforce credentialing will be essential for CODE to deliver the warfighter the decisive, surge ready supply chain capability and capacity the DoW Acquisition Transformation Strategy envisions.

A Framework for Industrial Surge Planning

As shown in Figure 2, the Acquisition Transformation Strategy prepares the DoW for an initial conflict. Platforms and initial stocks of weapons and consumables can be deployed to support an operational plan. In some instances (e.g., munitions), ongoing production rates may be sufficient to support replenishment needs after the initial 60–90 days. But for most commodities, a surge in production will be needed. The key idea in the framework for surge is to define pre-planned “switches” that can be activated at day 0 of the conflict to tap the increased industrial capacity needed for prolonged combat.

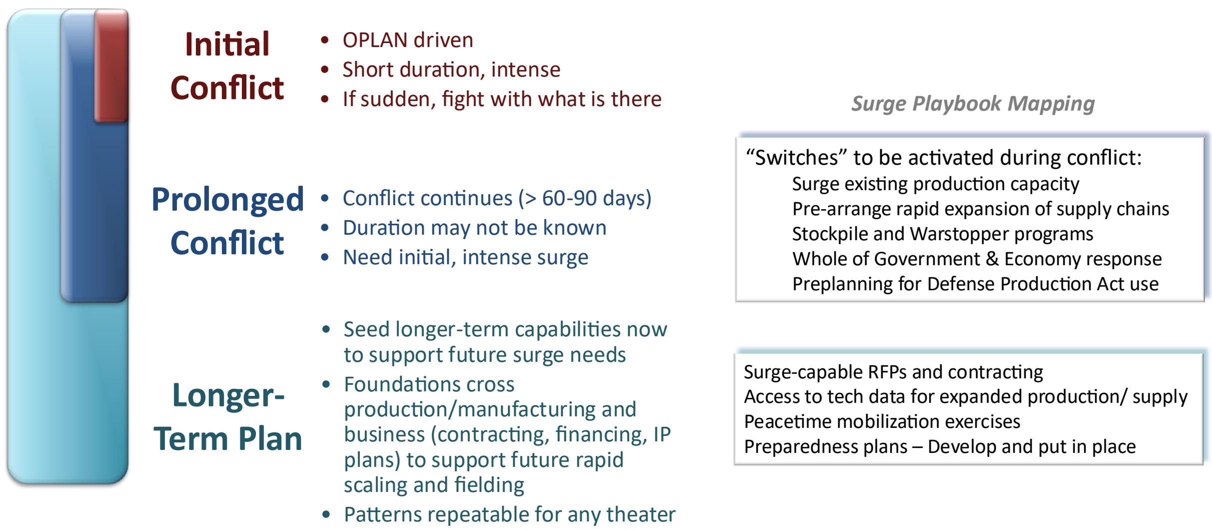

Figure 2. Planning for Industrial Surge

These switches need to be built into procurement contracts to provide pre-planned options and capacity for surge production rates. Beyond that, since the wartime demands may exceed the capacity of peacetime production facilities and supply chains, arrangements with additional suppliers are needed to prepare firms focused on commercial markets to be available for rapid switchover to defense production. The FY 2026 Defense Appropriation Act included $177 million to establish the Civil Reserve Manufacturing Network (Committee on Appropriations, 2025), a voluntary network of "dual-use" commercial manufacturing firms. These firms would be required to maintain the capability to rapidly "flip the switch" from commercial production to military production during a national emergency or conflict.

The Defense Logistics Agency (DLA) has long maintained programs in peacetime to ensure availability of materiel needed in wartime. The National Defense Stockpile (NDS) program stores "strategic and critical materials" that the United States cannot produce enough of domestically but are essential for national defense. Since the Cold War, the NDS has shifted from just storing raw minerals to focusing on "buffer stocks" of semi-finished goods and chemicals to protect the Defense Industrial Base (DIB) from global supply chain shocks. The DLA Industrial Preparedness program, also known as the Warstopper program, is focused on items that are vital to the wartime mission but not generally required in peacetime (Reece, 2025). Both the stockpile program and the Warstopper program have arguably been underfunded in recent years. They are vital to preparing for a rapid transition to wartime industrial mobilization.

As previously discussed, planning for a whole-of-economy response to wartime demands will require use of DPA authorities. In addition to current uses of DPA authorities, pre-planning could benefit from the use of Voluntary Agreements, as proposed by McGinn (2025). Voluntary agreements and plans of action between government and industry can provide peacetime benefits to the firms involved as well as wartime industrial capacity for national emergencies.

An important factor in rapidly expanding supply chains is the availability of technical data for the items to be produced. In some cases, these data are intellectual property held by the prime contractor that would need to be licensed to additional suppliers. In other cases, the government holds license rights for use of the data and can disclose it to additional suppliers.

Keeping the technical data up-to-date has been a past problem for the DoW. Research presented at past Naval Postgraduate School symposia has provided alternatives for patent pooling (Goertner et al., 2025) and for Technical Data as a Service (Thompson & McGrath, 2019). These alternatives may be on the critical path for industrial mobilization.

The office of the ASW (Industrial Base Policy) is developing plans for the Civil Reserve Manufacturing Network. This will be an important element of a written plan for industrial mobilization. It is unclear to the NDIA Surge Working Group who in government has overall responsibility for whole-of-economy mobilization planning.

A final element of this framework for industrial surge is recurring exercises and simulations to stress test supply chain responses to wartime scenario demands. Industry needs to be involved. Formation of industry boards to participate in classified and unclassified settings is needed for various industrial sectors that the DoW considers important in industrial mobilization. A modern version of the boards formed in WWII is needed, with provision for participation by allied industrial sources that the United States can count on in wartime.

Recommendations for DoW Consideration

1. Establish continuous government & industry wargaming for quantifying demand. Assign responsibility for consolidating DoW estimates of demand profiles in an extended conflict based on annual Defense Guidance and operational plans. Share these estimates in a classified setting with cleared industry and get industry inputs on where capabilities and capacity exist for the needed commodities. Involve industry annually in wargames to provide feedback on constraints and timelines. This could include the establishment of a classified scenario-working group that leverages lessons learned from the unclassified structure demonstrated with the NDIA Ad Hoc Industrial Surge Working Group (with government lead, industry partners, and academic analysts) while operating under appropriate DoW security controls.
2. Establish Industrial Mobilization Boards for critical manufacturing sectors. Expand the industrial base bench to include commercial and non-traditional supply chain participants. Use the Civil Reserve Manufacturing Network (CRMN) as the initial basis for planning industrial mobilization. Coordinate the plan with relevant agencies to build support for a whole-of-government response. Implement contracts or voluntary agreements with commercial firms to prepare for switchover to defense manufacturing short notice. Build out the supply chain ecosystem across the continental United States and with our allies. Within the Acquisition Transformation Strategy, continue to emphasize commercial contracting and use of commercial solutions to open commercial mobilization options.
3. Build out the digital ecosystem and data required to rapidly connect kill chain demand to supply chain response. Accelerate digital transformation and improved management of the technical data needed for repairs and rapid expansion of supply chains. Leverage current Industry momentum to build out a Collaborative Open Digital Ecosystem and Technical Data as a Service (TDaaS) solutions for securely and rapidly sharing U.S. DoW and warfighter demand with the trusted industrial base and increase visibility of supply chain capability and capacity with the DoW and warfighter.
4. Work proactively with industry associations to inform industry of evolving plans and obtain broad industry input on how to align government and industry interests in preparing for a mobilization contingency. Develop a Surge Playbook as a national asset for how to rapidly pivot the broader industrial base (commercial and defense) from

peacetime to wartime footing leveraging lessons learned on the needed switches and patterns established by the NDIA Ad Hoc Industrial Surge Working Group.

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References

Air Force Research Laboratory. (n.d.). (The defense industrial base: Integrated Product Team final report). *1999* (Report No. ADA367308). https://apps.dtic.mil/sti/tr/pdf/ADA367308.pdf

Albon, C. (2026). *Space Command to launch wargame series for industry*.

American Institute for Aeronautics & Astronautics & National Defense Industrial Association. (2026). *Toward realizing a collaborative open digital ecosystem* (AIAA SciTech 2026 Workshop Report [Unpublished], Issue NA).

Cancian, M. F., Cancian, M., & Heginbotham, E. (2023). *The first battle of the next war*. Center for Strategic and International Studies.

Cancian, M. F., Saxton, A., Bryan, L. A., & Helman, O. (2020). Industrial mobilization—Assessing surge capabilities, wartime risk, and system brittleness. *Naval Engineers Journal*, *132*(2), 39–49.

Cantrell, S. A., Margolis, C. H., Krauss, M. R., Pinon Fischer, O. J., & Mavris, D. N. (2025). *Digital twins for sustainment-oriented wargaming*. AIAA SciTech Forum, Orlando, FL.

Crowley, D. (2022). *Engine fleet readiness services*. https://standardaero.com/wp-content/uploads/2022/10/StandardAero-Maintenance-Insight.pdf

Defense Standardization Program Office. (2026). *Digital Standards Strategy*. https://www.dsp.dla.mil/Portals/26/Documents/Publications/2026_Digital%20Standards%20Strategy_010826.pdf

Federal Reserve Bank of Saint Louis (FRED). (2026). *Shares of gross domestic product: Government consumption expenditures and gross investment: Federal: National defense*.

Goertner, F., Lucyshyn, W., Crocker, J., O'Brien, T., Bailey, J., Elmaghraby, W., Hill, H., & Huddleston, R. (2025). *Time value of data decision modeling for major defense acquisition programs*.

Gunziger, M. A. (2021). *Affordable mass: The need for a cost-effecive PGM mix for great power conflict*. Mitchell Institute for Aerospace Studies.

Jones, S. G. (2023). *Empty bins in a wartime environment: The challenge to the US defense industrial base*. Bloomsbury Publishing.

Jones, S. G. (2025). *The American edge: The military tech nexus and the sources of great power dominance*. Oxford University Press.

McGinn, J. (2020). *Building resilience: Mobilizing the defense industrial base in an era of great-power competition*. The Heritage Foundation.

McGinn, J. (2025). *Options for strengthening the use of Defense Production Act Title VII*. https://acqirc.org/publications/research/innovation/options-for-strengthening-the-use-of-defense-production-act-title-vii/

National Defense Industrial Association Manufacturing Division. (2025). *NDIA & DRIVE contested logistics: Workshops summary & recommendations*. https://www.ndia.org/-

/media/sites/ndia/divisions/manufacturing/documents/ndia_drive_workshop-report_v5.pdf
National Research Council. (2002). *Equipping tomorrow's military force: Integration of commercial and military manufacturing in 2010 and beyond*. The National Academies Press. https://doi.org/https://doi.org/10.17226/10336
National Security Agency. (2026). *Zero trust implementation guideline primer* (Cybersecurity Technical Report Issue). https://media.defense.gov/2026/Jan/08/2003852320/-1/-1/0/CTR_ZERO_TRUST_IMPLEMENTATION_GUIDELINE_PRIMER.PDF
O'Hanlon, M. E. (2024). *U.S. defense spending in historical and international context*.
Reece, B. (2025). *Warstopper program changes could improve surge capabilities for critical supplies*. https://www.dla.mil/About-DLA/News/News-Article-View/Article/4157222/warstopper-program-changes-could-improve-surge-capabilities-for-critical-suppli/
Roosevelt, F. D. (1940). *Message to Congress on appropriations for national defense*. https://www.presidency.ucsb.edu/documents/message-congress-appropriations-for-national-defense-0
Shah, R. M., & Kirchhoff, C. (2024). *Unit X: How the Pentagon and Silicon Valley are transforming the future of war*. Simon and Schuster.
Stockholm International Peace Research Institute. (2025). *Unprecedented rise in global military expenditure as European and Middle East spending surges*.
Thompson, G. E., & McGrath, M. (2019). *Technical data as a service (TDaaS) and the valuation of data options*.
Tian, N., Lopes da Silva, D., Liang, X., Scarazzato, L., Béraud-Sudreau, L., & Assis, A. (2024). *Trends in world military expenditure*. https://www.sipri.org/sites/default/files/2025-04/2504_fs_milex_2024.pdf
Todd Lopez, C. (2026). *Department seeks counsel of industry leaders to advance Arsenal of Freedom*. https://www.war.gov/News/News-Stories/Article/Article/4405845/department-seeks-counsel-of-industry-leaders-to-advance-arsenal-of-freedom/
U.S. Department of War. (2025a). *Acquisition Transformation Strategy*. https://media.defense.gov/2025/Nov/10/2003819441/-1/-1/1/ACQUISITION-TRANSFORMATION-STRATEGY.PDF
U.S. Department of War. (2025b). *Reforming the joint requirements process to accelerate fielding of warfighting capabilities*. https://media.defense.gov/2025/Nov/10/2003819442/-1/-1/1/REFORMING-THE-JOINT-REQUIREMENTS-PROCESS-TO-ACCELERATE-FIELDING-OF-WARFIGHTING-CAPABILITIES.PDF
U.S. Department of War. (2025c). *Transforming the Defense Acquisition System into the Warfighting Acquisition System to accelerate fielding of urgently needed capabilities to our warriors*. https://media.defense.gov/2025/Nov/10/2003819439/-1/-1/1/TRANSFORMING-THE-DEFENSE-ACQUISITION-SYSTEM-INTO-THE-WARFIGHTING-ACQUISITION-SYSTEM-TO-ACCELERATE-FIELDING-OF-URGENTLY-NEEDED-CAPABILITIES-TO-OUR-WARRIORS.PDF
U.S. Department of War. (2026). *Department of War establishes new acquisition model to more than triple PAC-3 MSE production in partnership with Lockheed Martin*. https://www.war.gov/News/Releases/Release/Article/4371320/department-of-war-establishes-new-acquisition-model-to-more-than-triple-pac-3-m/
Vergun, D. (2020). During WWII, industries transitioned from peacetime to wartime production. *U.S. Department of Defense*, *27*, 233–254.
Welch, K. (2026). *Wargames keep warning us about congested logistics—It's time to take action*. https://mwi.westpoint.edu/wargames-keep-warning-us-about-congested-logistics-its-time-to-take-action/

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