THE ARSENAL OF DEMOCRACY

TECHNOLOGY, INDUSTRY, AND DETERRENCE IN AN AGE OF HARD CHOICES

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THE DEFENSE INDUSTRIAL BASE

The defense industrial base (DIB) is a critical component of national security, encompassing the network of facilities, skilled workforce, and supply chains responsible for producing and maintaining military resources. The DIB includes both public and private enterprises. It ranges from government-owned facilities to privately operated companies specializing in defense manufacturing and it increasingly includes companies that are not principally defense providers. It spans multiple tiers, from primary contractors who deliver complete systems to lower-tier suppliers who provide essential materials and components.

An effective DIB provides the capacity to rapidly produce and replenish military resources during times of crisis, ensuring that a nation can sustain prolonged military engagements. It contributes to deterrence by demonstrating to potential adversaries that a nation can endure losses and still prevail in a conflict over the long term. In addition, a robust DIB supports continual innovation and the preservation of technological superiority in defense systems, further dissuading adversaries from initiating hostilities. By contrast, when a nation has a weakened DIB, maintaining deterrence becomes more challenging, since it must persuade adversaries that its superior resolve and technological sophistication can overcome industrial deficits. Basing

deterrence on such threats increases the risk of miscalculation, potentially leading to war or even defeat. Other than the late Cold War case discussed earlier, there are no good historical examples of a country deterring a great-power rival with a superior defense industrial base simply by displaying a technological advantage.

Maintaining a robust DIB is particularly important for air-naval warfare. Armies rely primarily on large quantities of relatively simple and inexpensive platforms and munitions. By contrast, navies have traditionally depended on relatively small numbers of ships that are expensive, take years to build, and require specialized yards and technicians for maintenance and replacement. Air forces are somewhere in between. Aircraft are typically produced in much larger numbers than surface ships, but they have complex supply chains and require frequent maintenance.

Today, the DOD's procurement process and the broader DIB are undermining deterrence rather than supporting it. Bureaucratic inertia and entrenched interests have made the system grossly inefficient. Private contractors—operating in a high-risk market with the government as their sole customer—are prioritizing predictable, short-term profits over innovation and resilience. This system discourages producers of critical systems from maintaining spare production capacity, securing their supply chains, training and retaining younger skilled workers, and developing innovative new technologies. Reforming this structure will be essential to preserving deterrence over a five- to fifteen-year horizon.

Although there is no quick fix, several steps taken together could significantly improve the situation over the next five years. Congress could address perverse incentives within the DOD and with defense contractors by shifting to multiyear block buys, providing a clearer demand signal for producers and subcontractors. The president could also use the Defense Production Act to boost production of simpler products like artillery shells. Moving toward a productized sales model for high-tech products, including software, could further encourage Silicon Valley to support a robust defense tech start-up ecosystem. Con-

gress and the president can also reduce regulatory barriers to deepen defense cooperation with allies. These measures are complementary and likely need to be pursued in tandem, alongside directed spending to recapitalize key parts of the DIB, such as the yards that produce and maintain US submarines.

Each path faces practical and political obstacles. Congress will likely resist surrendering control over the annual budgeting process, and executive power alone cannot compel industry to rebuild the DIB. A venture capital–style model isn't a viable solution for complex systems such as warships, aircraft, and armored vehicles, which require extensive industrial capacity and yield limited profit margins. In addition, there are good reasons to regulate joint ventures with foreign defense producers, including protecting sensitive technology from espionage. Many members of Congress—and politicians from allied countries—would like to protect their domestic defense industry, even if that means their military must pay higher prices for inferior products.

Despite these difficulties, pursuing these reform approaches gradually and in parallel might work as part of a coherent overall vision for the future DIB. Congress could catalyze this effort by recapitalizing key parts of the DIB and reforming procurement processes. In the short term, these steps will inevitably benefit major contractors—Northrop Grumman, Lockheed Martin, Boeing, Raytheon (now RTX), and General Dynamics, along with the General Dynamics–owned Bath Iron Works and Electric Boat and Huntington Ingalls Industries, the primary US naval shipbuilders. Over time, the goal should be to drive innovation by making it easier for smaller, agile companies from the United States and allied countries to compete for contracts.

The World War II Model

Beginning in 1934 and accelerating in 1940, the United States initiated a crash mobilization of its defense industrial base. In 1934, US

defense spending was a modest $541 million, accounting for only 4.2 percent of the national budget. By 1940, spending had expanded to $1.6 billion and 7.7 percent of total expenditures. After the attack on Pearl Harbor, the nation could no longer avoid war, and defense spending skyrocketed, reaching $23 billion by 1942 and $75 billion in 1944, a staggering 68 percent of public expenditures.[1]

The "Vinson expansion," named for Carl Vinson, the powerful long-standing chair of the House Committee on Naval Affairs, is the paradigmatic example of a successful naval buildup. As a result of budget cuts in the 1920s and the Great Depression, the US naval industrial base had been hollowed out by the mid-1930s. Arms control agreements—the Washington and London Naval Treaties—artificially capped budgets by limiting naval construction. Vinson began laying the groundwork for naval expansion in 1934 with a succession of laws that improved naval financing and authorized new construction.[2] The process culminated in the Two-Ocean Navy Act of 1940, which further expanded the industrial base and called for a 70 percent year-on-year increase in the US fleet.[3] The target was met and the US fleet grew from 478 ships in 1940 to 790 in 1941. Over the next three years, the fleet continued to grow rapidly, reaching 1,782 in 1942, 3,699 in 1943, and 6,084 in 1944. From the perspective of maximizing conventional military deterrence, a bipartisan congressional consensus for a Vinson-style buildup would represent the DOD's ideal outcome.

Unfortunately, the Vinson naval buildup was possible because of unique historical circumstances that no longer apply. In the 1930s, the US DIB had muscle memory formed in the crash mobilization for World War I, and the broader industrial base was robust.[4] Naval technology was also less complex then; both warships and merchant vessels were simpler in design and construction, making rapid production increases more feasible. The political landscape, too, was uniquely favorable. Democrats controlled the White House and large majorities in both houses of Congress, which enabled Vinson to push through his agenda by striking deals directly with President Franklin Roosevelt. The international situation also created a clear sense of urgency—

most of Western Europe had already fallen under Nazi control, and war with Japan seemed increasingly likely. Today's geopolitical environment is dangerous and deteriorating, but the public does not yet perceive the urgency that would justify bipartisan support for a massive increase in military spending. Despite a Republican majority, the normalization of the filibuster now requires sixty-vote supermajorities for legislation to pass the Senate. Furthermore, the fiscal situation is more challenging today, as the United States today spends more on interest payments than defense for the first time in its history.[5]

Even though defense budgets in the next decade are unlikely to boom as they did in the early 1940s and 1980s, there are signs of momentum in Congress for significant increases, as well as structural reforms to make procurement more effective. In May 2024, Senator Roger Wicker (R-AL), the ranking member of the Senate Armed Services Committee, released a plan for a "generational investment" to modernize the US armed forces, raising defense spending from 2.9 percent of GDP to 5 percent within five to seven years.[6] "We do not need to spend this much indefinitely—but we do need a short-term generational investment to help us prevent another world war," Wicker wrote in a *New York Times* essay about the plan.[7] In addition to funding increases, Wicker's plan proposes a raft of reforms to the DIB, the procurement process, personnel management systems, and more. Even though Wicker's plan seems unlikely to be taken up in full, bipartisan consensus is growing on several issues discussed in this chapter, including the need to reform the procurement system for high-tech products and revitalize the submarine industrial base.[8]

The essential challenge is that it is no longer possible to grow the DIB by rapidly expanding existing factories or repurposing facilities from the civilian sector. The key military aircraft in World War II still had sufficiently straightforward designs that production could ramp up quickly.[9] The US government's War Production Board oversaw the conversion of automobile factories, exemplified by Ford's Willow Run plant, which produced thousands of B-24s.[10] The resulting production

surge significantly boosted the Allies' airpower, supporting sustained air campaigns and contributing to the overall war effort.[11] In the following decades, aircraft production came to rely more on specialized materials and electronic components. Production timelines expanded.

An aircraft buildup at the scale of World War II is difficult to imagine today. Much like warships, aircraft are significantly more complex, with sophisticated supply chains and internal electronics necessitating long lead times to build out aircraft production. However, compared with the maritime industrial base, the aerospace industrial base is significantly healthier. The United States has two major shipbuilders, Huntington Ingalls Industries and General Dynamics, both of which face serious issues expanding production quickly. By contrast, the aerospace industrial base includes three major full-service manufacturers (i.e., those that produce complete airframes): Boeing, Lockheed Martin, and Northrop Grumman. All have serious capacity constraints, and Boeing famously has management issues, but in general they are less troubled than their naval counterparts.[12]

The Procurement Process

The current DOD procurement system was developed by Secretary of Defense Robert McNamara in the 1960s.[13] Previously, the DOD had no standard procedure to adjudicate between the services' competing budget priorities and strategic visions. Instead, the services lobbied Congress for resources and bargained with one another. Service planning, training, and operational execution were all largely independent, even though the Joint Chief system existed on paper. The disadvantages of this decentralized system became increasingly obvious during the 1950s, as technological innovation made defense production increasingly specialized and each of the services came to understand that it would have enduring global responsibilities. Absent coordina-

tion between services on the programmatic level, the United States was effectively maintaining four separate militaries with noncomplementary capabilities, rather than a single joint fighting force.

The Soviet Union, by contrast, exploited its centralized political system to coordinate procurement among its services. Interservice rivalry did exist in the Soviet Union, as it does in all militaries. The Soviet Navy, under the leadership of Admiral Sergey Gorshkov, was particularly jealous about guarding its independent strategic deterrence and expeditionary mission. Still, the Soviet General Staff was able to develop a reasonably coordinated interservice plan, particularly because it had lower turnover in the top echelons. Gorshkov led the Soviet Navy for nearly thirty years, while the Soviet Ground and Air Forces had multiple chiefs who held their posts for more than five years. (By contrast, only two American service chiefs served for more than five years during the entire Cold War.[14]) These factors helped the USSR to achieve near parity in its military industrial base and the combat readiness of its force, despite the Soviet Union's structural economic disadvantages, particularly during the low-readiness period of the mid-1970s. Mindful of these institutional issues, the current system is intended to produce coherent procurement across services, ensure that money is accounted for, and rationalize programs toward the DOD's strategic priorities.

The DOD's Defense Acquisition Process, known by some as "Big A," is hugely complex and highly bureaucratic.[15] The resulting delays and institutional bloat can be deeply frustrating. Still, they serve a purpose. Any organization as large and complex as the US military needs procedures to set priorities, responsibly manage its existing assets and partnerships, and maintain a vast workforce and ecosystem of contractors. The process is designed with the goal of balancing force transformation—the integration of new technologies and military concepts—with force readiness—the ability to fight at a moment's notice.

The procurement system that McNamara created has three parts: the Defense Acquisition System, the Joint Capabilities Integration and

Development System (JCIDS) process, and the Planning, Programming, Budget, and Execution (PPBE) process:

- The Defense Acquisition System, or "Little A," handles "project management."[16] It has five phases, from initial planning to operations and sustainment, allowing the Pentagon to track a program from conception through retirement.
- The Joint Capabilities Integration Development System is the "military-technical" function of the system.[17] Under JCIDS, the regional combatant commanders develop requests in consultation with the services (US Army, Navy, Air Force, Marines Corps, and Space Force) in their areas of responsibility. The Joint Chiefs of Staff review these requests and decide how to allocate acquisition requirements and new programs. The JCIDS is the Joint Chiefs' most powerful tool over procurement. The chairman of the Joint Chiefs of Staff has particularly broad powers in practice.
- Planning, Programming, Budgeting, and Execution is the financing process.[18] PPBE involves various analytical checkpoints. Program executives, mostly civilians, generate funding requirements for programs and track their quarterly progress.

Most DOD acquisition programs take only a few years, but the largest and most important take decades and cost billions. Little A, JCIDS, and PPBE provide constant oversight for these programs through their life cycles. Across the procurement system, there is often misalignment between civilian leadership in the Office of the Secretary of Defense (OSD) and military leadership in the Joint Staff. Officials on the military side often favor a stronger role for the Joint Staff, arguing that it has more relevant expertise.

During the Reagan administration, the system proved that it was capable of a massive naval modernization program to rival the Vinson buildup. Reagan won the presidency in a landslide in 1980 on a strong anticommunist platform, gaining a mandate to hike defense

spending.[19] His Secretary of the Navy John Lehman and Defense Secretary Caspar Weinberger led the push for a major force expansion, termed the "600-Ship Navy."[20] Three new *Nimitz*-class supercarriers were built, each completed in under four years rather than the previous construction time of five years. The DIB was able to deliver this expansion on schedule because the United States had yet to repeal the protections for domestic shipbuilding that shielded US yards from more competitive Asian and European producers. Reagan eventually repealed these subsidies—but a flood of contracts for destroyers, frigates, and carriers kept the largest yards afloat.[21] Even then, US industry did not shoulder the entire load. Lehman extended the service life of smaller ships, while also putting old ships like the *Iowa*-class battleships back into service. He even proposed reactivating the *Oriskany*, a World War II–era carrier.[22] The Navy had enough money, manpower, and yards to keep legacy ships usefully in service while US shipbuilders ramped up production.

Forgetting the Cold War

The procurement process is reasonably effective at overseeing acquisitions of large programs, but it has proved much less effective at maintaining a robust DIB since the end of the Cold War. Over the past thirty years, Congress's lack of political will to sustain the DIB, coupled with the US military's focus on a small number of big-ticket programs, has allowed productive capacity for major capabilities to atrophy. Meanwhile, Congress and the DOD have continued on autopilot to spend roughly equal amounts on the Army, the Navy, and the Air Force. This approach reflects bureaucratic inertia, not strategic prioritization. A smarter approach would align spending across services with the most urgent threats—which are air and naval in nature.

After the Korean War, the United States began to shift defense production from state-owned facilities to private companies. Defense

contracts were spread among twenty to thirty firms, creating a large and relatively diversified DIB.[23] The government generously funded basic research for advanced technologies such as jet engines, advanced missiles, long-range communications, and space-based assets. This created a virtuous cycle: industry developed initial programs that evolved through multiyear or multidecade acquisition processes. Many of these technologies were also commercialized, and the DOD would later buy products such as computer chips "off-the-shelf."

The 1986 Goldwater-Nichols Act marked a turning point for both the DIB and the procurement system. The law established a streamlined chain of command from the president through the secretary of defense to the newly created combatant commanders.[24] It also designated the chairman of the Joint Chiefs of Staff as the president's sole military point of contact, sidelining the service chiefs (the secretaries of the Navy, the Army, etc.). These changes aimed to promote interservice cooperation and prevent any one service from dominating decision-making. The complex acquisition system, governed by the Joint Staff and OSD, is meant to mitigate interservice rivalry and bureaucratic politics, allowing US defense budgeting to follow rational principles, with spending stemming from technological, force design, and ultimately strategic needs. Today, however, the system is not working as it should.

In a rationally designed force that actually functions along the lines articulated in the budgeting process, one would expect to see significant variation between service budgets in both absolute and relative terms outlays over time, as the Pentagon adapts to new threats. In fact, the opposite is true. The services' budget allocations in each defense budget are nearly identical (see fig. 6.1). In 2018, the Army and Navy departments received around $240 billion each, and the Air Force received around $235 billion. In 2023, top-line budgets increased from 2018, but both the Air Force and the Navy received almost exactly $312 billion, the Army $284 billion.[25] Other countries such as the United Kingdom have deliberately sought such a balance, arguing that a "balanced force" is appropriate for achieving a wide range of tasks.[26]

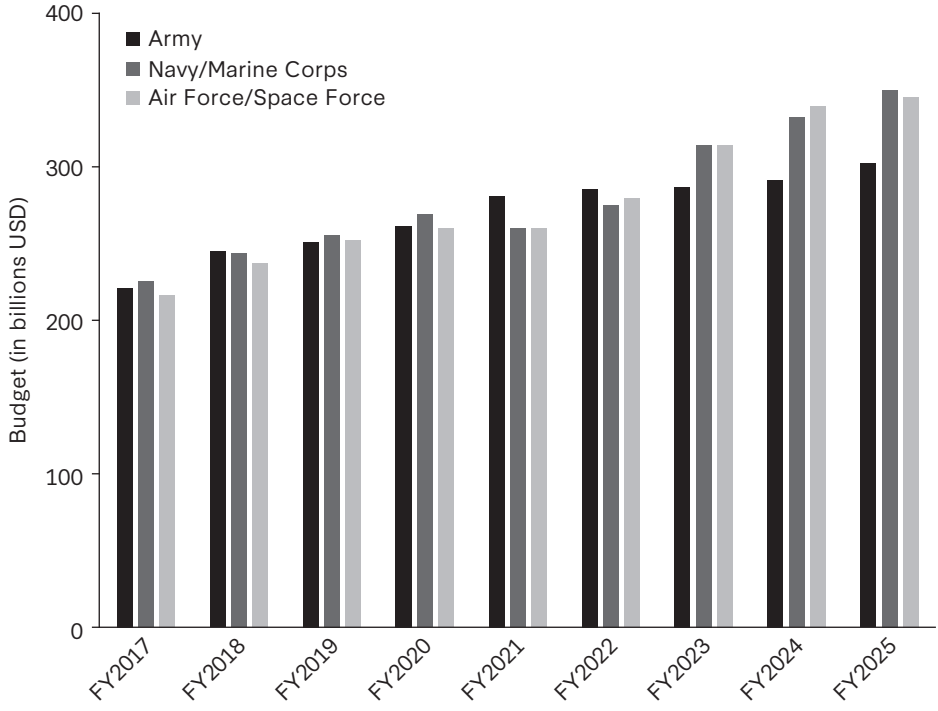

Figure 6.1 DOD budget by service

Source: USAspending.gov, "Agency Profile: Department of Defense" for various years, https://www.usaspending.gov/submission-statistics/agency/097.

However, in an era of great-power competition and budget constraints, an unquestioning search for "balance" suggests a bureaucracy on autopilot, rather than a considered attempt to match the force to the highest-priority threats and challenges.

The Goldwater-Nichols Act's emphasis on joint operations has also created an unintended tension between joint planning and service-specific strategy development, particularly visible in the Indo-Pacific theater.[27] Although the region's maritime character logically suggests that the Navy should play a leading role, supported by the Air Force and the Marine Corps, the JCIDS procurement process makes such prioritization difficult. Institutional barriers in the joint process make it challenging to shift resources between services—for example,

reallocating funding from land forces to maritime capabilities for Indo-Pacific contingencies. Joint procurement provides valuable oversight and coordination, but it can also dilute accountability for program management and complicate the development of service-specific operational concepts tailored to regional challenges. This helps explain why service budgets remain remarkably equal even when strategic priorities would suggest otherwise.

The end of the Cold War, which came on the heels of Goldwater-Nichols, also forged today's DIB. By 1991, the United States had over fifty aerospace and defense contractors that produced major systems, a dozen naval-focused contractors, and hundreds of subcontractors that created specific components for larger projects. When the Cold War suddenly ended, strategic requirements changed and budgets were cut.[28] With DOD encouragement, the DIB consolidated production of all major systems into six contractors: Lockheed Martin, Raytheon (now RTX), General Dynamics, Boeing, Northrop Grumman, and Huntington Ingalls.[29] Between the mid-1980s and the mid-1990s, defense spending fell by over 20 percent in real terms, with procurement of new systems being the hardest-hit line item owing to the difficulty of laying off personnel.[30] This period marked the beginning of an ongoing consolidation trend.[31]

The idea was that a smaller military needed a smaller, leaner, more tech-focused DIB. Optimists hoped that the more consolidated DOD would benefit from economies of scale, with the primes now incentivized to develop ultra-high-tech programs over very long timescales. In the spirit of the Revolution in Military Affairs, the future force was going to emphasize networked capabilities, communications, stealth technology, and precision strike.

For around fifteen years, this new approach to the DIB seemed effective. The F-35 Joint Strike Fighter, B-2 Stealth Bomber, and *Ford*-class aircraft carrier were all products of this post–Cold War DIB. All three were impressive technological achievements—though as we saw in chapter 1, all faced industrial challenges and came in late and vastly over budget. The new DIB also adapted to build exquisite, high-tech

systems to support operations in the Global War on Terror that minimized US casualties. In 2003, Operation Iraqi Freedom seized Baghdad in less than three weeks—even without access to Turkish bases and with a relatively small invasion force and rapid campaign timeline. The nimble, high-technology force of the RMA was seemingly vindicated. Unfortunately, this was no longer a DIB capable of supporting a war against a great-power rival.

Warning Signs

Cracks began to appear in the mid-2000s, as Operation Iraqi Freedom turned into a counterinsurgency campaign. By 2006, guerrilla groups were deploying increasingly powerful improvised explosive devices (IEDs) that could penetrate the thin armor on US lightly armored vehicles. By 2007, around two-thirds of coalition casualties were from IEDs.[32] In response, the DOD launched the Mine-Resistant Ambush-Protected (MRAP) program, developing trucks with additional armor and explosive-resistant designs.[33] Although the program ultimately succeeded in reducing casualties through the deployment of over twelve thousand MRAPs in Iraq and Afghanistan, it came at a substantial cost of $50 billion. More concerning still, bureaucratic red tape, supply chain challenges, and technical issues delayed the program by years—but no major reforms followed.[34] Reform would have required consensus among OSD, Congress, and defense contractors, and no such consensus existed.

Today, the DIB and procurement process face the same problems of bureaucratic delays and supply chain issues of the MRAP program, but on a much larger scale and with much higher stakes. Production capacity for ammunition and other essential articles has atrophied due to the shift toward precision-guided munitions, a focus on just-in-time manufacturing, and a weak demand signal that has led producers to underinvest in modernizing production lines. When Russia invaded Ukraine in 2022, it exposed just how unready the American DIB had

become. As of this writing, Ukraine fires between 90,000 and 150,000 artillery shells per month, the vast majority of which are now NATO-standard 155-millimeter shells. Before the war, US 155 millimeter artillery shell production was around 15,000 rounds per month, enough for less than a week in current combat conditions.[35] By May 2024, US production had risen to 28,000 rounds per month, with plans to increase to 70,000 per month by 2025 and 85,000 by 2028.[36] Thankfully, US allies still had functional capacity and stockpiles to draw on in the meantime.[37] In a prolonged air-naval conflict with China, the United States would face similar challenges but would not be able to lean on its allies in the same way. It is much harder to expand production lines for sophisticated weapons than artillery, since they require specialized components and a highly skilled workforce. The more complex the supply chain, the greater the risk that a single point of failure can limit production of the final product. As we saw in chapter 3, this issue is a key bottleneck for the United States as its ramps up production of long-range missiles.

The calcified procurement system also discourages private industry from developing products with more resilient supply chains, even if the new proposed design has identical specifications to an old system. Big A's multiple layers of evaluation and review are supposed to keep complex programs on track. But OSD no longer has the internal knowledge to do this effectively, and the Joint Staff has limited authority and oversight. As a result, a new weapon must go through years of tests and evaluation before it reaches front-line forces in low numbers, and only then can it be procured at scale. By refusing to test and deploy new products quickly, the Pentagon locks itself into older options with more brittle supply chains.

In addition to shortfalls of physical manufacturing infrastructure, the DIB faces endemic workforce issues. As with the Merchant Marine, the demographics are dismal. From entry-level workers to digitally skilled workers and executive-level management, the DIB is plagued by an aging workforce. The shipbuilding enterprise is partic-

ularly affected. The average age of the workers at BAE Systems Ship Repair yard in Jacksonville, Florida, is fifty-five. As experienced managers retire, shipyards are struggling to fill even entry-level vacancies with the appropriate number of workers. Recruiting out of high school is not as straightforward as it once was, given the job market pressure to get a college degree.[38] Companies, too, are leaving the DIB. Counting subcontractors, over seventeen thousand have left the DIB in the past five years.[39] Workforce problems are already causing delays in the construction of critical ships. Delivery of the *Constellation*-class frigate, for example, was delayed by three years owing to what Secretary of the Navy Carlos Del Toro has called an "atrocious" workforce retention rate.[40] In the words of Michael Paxton, president of the Shipbuilders Council of America, "I think the single biggest issue facing the industry is people."[41] An estimated 140,000 jobs in the submarine industrial base alone will need to be filled in the next decade.[42]

There are several industry-specific issues for poor retention rates. In higher-skilled jobs, the DIB struggles to compete with more attractive private-sector wages due to the heavy consolidation and thus lower competition among DIB companies. Cross-sector issues with wage inflation hit the DIB particularly hard due to the comparative lack of wage flexibility in the DIB, which in turn reflects the fixed-price nature of defense contracts.[43] The contract-by-contract nature of the defense industry can also make workloads unpredictable. Once workers are laid off, it is very hard to encourage them to return to the industry and expensive to retrain them according to the demands of the new workflow.[44]

Industry has tried various tactics to increase retention. At Fincantieri's Marinette Marine shipyard in Wisconsin, the Navy has offered $5,000 retention bonuses to employees after their first year and another $5,000 if they stay on until the ship is delivered.[45] The Navy has also launched a talent pipeline program in areas near key yards.[46] Wisconsin has implemented a shipyard training program, in partnership with Fincantieri, to generate more apprenticeship slots for naval

construction.[47] Across the wider DIB, efforts are being made to retrain recent veterans in skilled work to address worker shortages.[48] Defense contractors such as Lockheed Martin are exploring relationships with universities to establish their own skilled talent pipelines.[49]

Ultimately, however, wages will have to rise to attract and retain capable engineers. To support these efforts, the budgeting process for personnel can be reformed. Currently, shipyards must repeatedly petition for financial support to fund bonuses, with each request facing uncertain outcomes that can disrupt operations. A more effective approach would be for the Pentagon to incorporate bonus and workforce retention funding into the initial budget allocation when contracting new ship construction. The US education system also needs to better equip vocational students with the technical and practical skills required by engineering disciplines. Congress can support this effort by expanding grant programs for vocational training and incentivizing engineering education, ensuring that the defense industry has a robust pipeline of skilled, security-cleared talent to meet its growing needs. The talent problem is another reason to consider producing in trusted ally countries and buying from these countries' producers when appropriate.

In short, given the state of the DIB, the United States currently lacks the capacity to scale up production of many key systems quickly. It would be impossible, for example, to rebuild the Navy's surface fleet today anywhere near as fast as the Reagan administration did in the early 1980s. The Navy today has far fewer ships laid up in storage that could usefully boost combat power than it did in the 1980s.[50] It also has severe shortages of crew and maintenance workers even with a fleet that has declined below three hundred.[51] A rapid expansion of the fleet would require a major recruiting drive and an aggressive manpower training and retention program, as well as possibly an expansion of existing yards. Even setting aside the risks of supply chain security and reliance on China for subcomponents, the state of the DIB is likely already undermining deterrence.

A Question of Political Will

Elected officials have allowed the DIB to atrophy because they have been unwilling to accept the trade-offs that recapitalization of the DIB would require. Even though the United States has an enormous top-line defense budget—nearly $850 billion in its FY 2025 budget request, or more than 3 percent of gross domestic product (GDP)—the DOD actually has very little budgetary breathing space to redirect resources to fix the DIB.[52] Decades of past procurement decisions have produced a current force that must be maintained at great expense. The DOD and the private firms that compose the DIB do not have the luxury of abandoning these programs indiscriminately to free up funding for a high-tech future force. The United States also cannot withdraw forward-deployed forces from sensitive regions like the Middle East and Europe without the risk of triggering instability and undermining US diplomatic goals. Nor can the DOD easily free up funds in other places, since US military spending is mainly devoted to personnel, not procurement. The US military runs an all-volunteer force, rather than relying on conscripts as China and Russia do. This means it must pay its personnel competitive wages. Pressuring personnel can also create a vicious cycle. Manpower shortages require remaining personnel to go on longer and more frequent deployments, which reduces retention.[53]

Recapitalizing the US DIB will therefore require a political mandate. Reagan enjoyed such a mandate after his landslide victory in 1980. In today's context, with a de facto hurdle of sixty votes to pass legislation through the Senate, major force recapitalization would probably require bipartisan cooperation. The president would have to support this effort and facilitate compromise and collaboration across the aisle in Congress. Furthermore, a bipartisan consensus will need to be reached on the need for reform to the system itself. The crisis in the DIB is the result not just of underinvestment, but of structures of perverse incentives that permeate the defense procurement

system. Addressing the challenge comprehensively will require Congress to do more than simply spend more money.

Possible Avenues for Reform

Congress and the DOD have four basic reform pathways:

1. Fix the perverse incentives within the DOD and between the DOD and the primes.
2. Use the Defense Production Act to prioritize military industrial production.
3. Adopt a "productized sales model."
4. Deepen defense industrial cooperation with allies.

None of these options precludes any other. Indeed, they almost certainly need to be pursued in tandem. Each faces practical and political challenges and is therefore likely to be taken only incrementally.

Fix Perverse Incentives

Incentive systems are broken inside the DOD. OSD and the chairman of the Joint Chiefs have institutional incentives to seek compromise and consensus between the services even when ruthless prioritization is required. They sometimes seek compromise even when the services themselves might well produce more coherent strategic, operational, and budgetary plans if they actually received the leeway to do so. Divesting expensive systems and canceling programs is politically difficult within the DOD and Congress.

One reform pathway is to give either the Joint Chiefs of Staff or OSD centralized power over force structure development. Former Chairman of the Joint Chiefs of Staff Mark Milley, in his valedictory essay in *Joint Force Quarterly*, proposed appointing a "Jointness Czar" with ultimate responsibility for technological integration and force

design.[54] Given that the chairman is already supposed to act as the Jointness Czar, this proposal might be read as suggesting that the Joint Chiefs should gain more power over force design. The counterargument is that the Joint Chiefs intimately understand military operations but are not organized to lead the DOD's interaction with the private sector.

An alternative to centralized procurement would be to let the services run their own acquisition programs, as they did before McNamara. The Navy would benefit the most from such a change. Its procurement timelines are the longest of all the services and require structured planning over budgetary cycles.[55] Even small surface combatants like the *Constellation*-class frigate or Littoral Combat Ship program are far more expensive than all but the most sophisticated purchases for the other services.[56] Devolving control also carries an obvious risk: It would make the Joint Force more fragmented and prevent consistent oversight and review for programs as costs increase. However, a more decentralized procurement structure may be appropriate for the particular challenge the Joint Force faces today in the Indo-Pacific, which affects the services to different degrees and in markedly different ways. Giving more flexibility to the Navy and the Air Force would allow them to move faster and place more calculated bets.

More broadly, the process is failing to send demand signals to the primes that match actual US strategic needs. The primes build what the DOD requests they build and what they anticipate the DOD will request in the future. Thus, ultimate responsibility for a misalignment of incentives rests with OSD and the Joint Staff. When future demand is uncertain, primes' incentives are to focus on producing high-end, exquisite systems that need to be maintained and serviced over many years, thereby locking in long-term future cash flows. Each of the primes specializes in different areas, and competition for many contracts is weak. The primes subcontract many of their components, both high-end and low-end, and focus on project management and final assembly. The business model is not dissimilar to

Boeing's approach to commercial aircraft construction or General Motors' approach to automaking.[57] The worst production bottlenecks are typically at the subcontractor level. The primes have only limited ability to solve these problems when they occur. In some cases, they may not fully understand their subcontractors' supply chains. The current system provides no incentive for the primes to make major capital investments to produce cheaper low-margin products in quantity.

Under the current system, the primes have no incentive to invest in production capacity unless they are very confident of long-term demand. DOD regulations limit multiyear contracts to major programs such as warships and fighter jets.[58] The Pentagon and the services frequently pack their budget requests with an unfunded priorities list. Congress then demands additional spending on systems the services do not request, leading to cuts to long-range research and development and the Pentagon's procurement preferences.[59] For similar reasons, contractors have reasons not to trust the DOD, which in the past has demanded specific production expansions and pledged to make long-term investments worthwhile—only to cancel the contracts and leave industry in the lurch. This perverse incentive is one reason why US artillery producers were so slow to ramp production in the eighteen months after Russia invaded Ukraine in February 2022. Contractors—and, more important, subcontractors—don't know how DOD demand might change in the future. Investments in spare capacity are very expensive and not worthwhile if demand will evaporate after a year or two.

There is an emerging bipartisan consensus that longer-term contracts are necessary for a wider range of basic defense implements. In fact, the 2024 National Defense Authorization Act (NDAA) approved $8 billion for munitions procurement and permitted the DOD to purchase in long-term contracts.[60] The 2024 NDAA was a good first step, but even clearer demand signals are needed for missiles, submarines, UAS, and related componentry.

Invoke the Defense Production Act

The Defense Production Act (DPA) authorizes the president to compel businesses to take contracts critical to national defense, allocate critical resources to defense purposes, and redirect equipment to nationally critical industries.[61] There is ample precedent for invoking the DPA in both wartime and peacetime:

- Harry Truman invoked the act during the Korean War to accelerate military production, leveraging spare capacity from World War II.[62]
- Dwight Eisenhower used it to create a heavy metals industry virtually from scratch by authorizing direct loans and labor support to aluminum and titanium.[63]
- Richard Nixon and Jimmy Carter used it to encourage domestic oil production.
- Donald Trump used it before COVID-19 to expand critical minerals stockpiles and later, during the pandemic, to accelerate ventilator production.[64]
- Joe Biden used it to accelerate production of vaccines, personal protective equipment, and green tech.[65]

However, the DPA is not a panacea. Private contractors and subcontractors will inevitably be an essential part of any robust DIB. The government is not capable of micromanaging the highly complex supply chains that support production of today's advanced defense articles. Ordering production increases is therefore not an alternative to fixing the perverse incentives that broke the DIB in the first place.

The fact that Biden did not invoke the DPA during the Russia-Ukraine war is informative. If General Dynamics' Scranton artillery plant could have produced 100,000 155-millimeter shells per month during 2023 and 2024, it would have done so.[66] If Raytheon (now RTX) had capacity at its Tucson plant, it would have quadrupled Stinger production—even at the cost of a short-term loss.[67] Using the

DPA comprehensively would require intensive, ongoing federal management of complex supply chains. If private firms face bottlenecks from shortages of components or skilled workers, the federal government is not typically positioned to fix these problems faster than the companies themselves. Several prominent Democrats and Republicans in Congress have proposed invoking the DPA in limited circumstances, including for artillery, but few believe that excessive reliance on central planning is a good way to modernize and expand the DIB in general.[68]

Move to a Productized-Sales Model

Today, many Pentagon contracts for complex development programs follow a "cost-plus" model. Under these arrangements, contractors are reimbursed for allowable costs plus a fee (profit) that can be structured in different ways: fixed, incentive-based, or award-based. The cost-plus model is designed to protect contractors from cost risk in uncertain programs and is just one part of a broader contracting system that includes fixed-price contracts for more predictable work. The primes maintain their profitability through a mix of these contract types, as well as sustainment work, international sales, and IP licensing.

One potential procurement reform would be to move away from cost-plus contracting and toward a productized-sales model. Private companies would invest their own capital to innovate and develop technologies, which they would then sell to the DOD as ready-to-use products, rather than navigating the bureaucratic headaches of the traditional procurement process. A productized-sales model would in principle allow the DOD to benefit from faster development cycles and more rapid integration of cutting-edge technologies. Supporters also argue that a productized-sales model would increase competition, driving innovation and reducing costs.

The productized-sales approach is also known as a venture capital (VC) model. In the VC ecosystem, investors provide funding to start-

ups and emerging companies with high growth potential in exchange for equity. This funding enables these companies to develop innovative products and bring them to market quickly. Under a VC model with productized sales, the DOD itself might invest directly in promising start-ups that it hopes could produce successful products for it in the future, sharing the financial risk and incentivizing rapid technological advancement. Of course, contracts would have to be structured carefully to align companies' incentives with the DOD's.

Since the Obama administration, the DOD has been experimenting with variations on VC procurement on a small scale. The Defense Innovation Unit (DIU) experimental facility helps start-ups and founders apply for departmental contracts.[69] It is also actively developing a footprint on the campuses of leading engineering and business schools to encourage the emerging defense tech ecosystem.[70] DIU put seventeen commercial technologies into service in 2022.[71] The DOD already has access to four American cloud-computing vendors and will complete its cloud transition within four years.[72] Project Maven, the DOD's secretive AI targeting program, is another example.[73] The DOD can harness the private sector's unique innovative abilities without moving the entire department to a productized-sales model simply by expanding the budget and procurement authority of existing initiatives like DIU.[74] Anticipating that this trend is inevitable, private venture capital has flooded into the defense tech sector. Start-ups in the space raised over $100 billion in mostly private investment in the three years preceding this book's writing, five times the level of a decade ago.[75]

However, there is only limited evidence of a broad transformation in the Pentagon's approach to high-tech procurement under the Biden administration. In the 2023 fiscal year, venture-backed companies won less than 1 percent of the $411 billion in DOD contracts awarded.[76] Industry accuses the Pentagon of keeping technologies in the "valley of death"—the period between basic research and development and adoption in the defense budget.[77] Only one defense tech company—Palantir—has successfully made it to an IPO.

The main problem with the VC model is that it is hard to customize most civilian technologies for use in a high-speed, adversarial combat environment. Defense-specific technology products are risky bets at the early stage, since there is only one potential customer. (US allies are potential customers only if regulations allow cutting-edge defense technologies to be exported, which in many cases they do not, as we will see shortly.) If private companies developed and marketed technologies directly to the Pentagon, more innovative technologies would probably be adopted, and more quickly, but the failure rate would increase markedly.

The VC model is not appropriate for large platform systems like surface ships, fighter aircraft, and submarines that involve enormous capital expenditure, high unit costs, ongoing maintenance, and complex supply chains. These platforms require extensive systems integration, testing, and certification processes that typically extend beyond the time frames and capabilities that VC-backed companies can support. They must also integrate seamlessly with existing military infrastructure, communications systems, and operational procedures. In addition, these large platforms depend on maintenance of specialized industrial capabilities, skilled workforce development, and secure supply chains that are strategic national assets—capabilities preserved through the long-term, stable relationships of traditional defense contracting. The need for decades-long sustainment, including maintenance, upgrades, and parts availability, further favors established defense contractors with proven track records over VC-backed startups that typically aim for shorter-term returns.

However, a hybrid approach could be effective. Traditional prime contractors could keep developing core platforms while VC-backed companies provide innovative subsystems, software, and modular upgrades. For example, a prime contractor might build the aircraft's physical structure and a VC-backed company could develop advanced sensors, AI-driven mission software, or secure communications systems, creating a more adaptable and capable platform. This approach could help bridge the "valley of death" between R&D and full deploy-

ment, as innovative components could be tested and integrated into existing platforms more rapidly than entirely new systems.[78] The VC model is ultimately better suited for unmanned systems of all types, satellites and communications systems, modular componentry, and software—areas where rapid innovation and shorter development cycles can provide immediate tactical advantages. A complementary, hybrid model would allow the DOD to harness private-sector innovation without compromising the stability essential for critical defense platforms.

DIU's successes demonstrate the promise of commercial defense collaboration, even though the DIU model cannot fully displace the traditional procurement process. A demonstrative example is the DOD's ability to provide Synthetic Aperture Radar (SAR) data to the Ukrainian military. Unlike normal space-based surveillance, which is essentially a visual feed, SAR provides a radar-based reconstruction of terrestrial objects, allowing it to bypass various forms of cloud cover and other weather disruptions. DIU has partnered with private firms developing satellite-based SAR for years, allowing the DOD to quickly connect these capabilities to Ukraine's targeting cycle.[79]

The most natural way to leverage these crucial civilian-derived capabilities, and to ensure Pentagon financial support for long-term procurement in fast-moving areas like satellite reconnaissance and drone forces, is to establish a new procurement pathway, which some have called a "capability-of-record." Rather than using the traditional procurement process to link funds to a specific vendor, a capability-of-record model would provide the Pentagon a pot of cash it could rapidly redirect between vendors, ensuring that the DOD keeps pace with private-sector innovation.[80]

Practically speaking, shifting to a VC model would require significant cultural and procedural reforms. The DOD is a risk-averse organization and individuals within the system are personally disincentivized to support programs that fail. If the acquisition system is to be allowed to contract for new technologies that have not yet checked every box, new accountability metrics will need to be created to assess

the DOD's return on investment. Pricing models for contracts will have to reflect the risk that the DOD is taking on early-stage projects, while founders and investors will also need to enjoy margins high enough to justify their speculative bets. The DOD will have to offer more transparency to industry about its future acquisition plans to support efficient capital allocation, and the services will have to become more transparent about the systems they need and the timelines on which they would want to procure them. Congress would also have to relinquish budgetary power by giving the DOD authorization to offer multiyear contracts to start-ups. Each of these changes is doable in principle, though taking them together will be painful for both Congress and the DOD. Vested interests, including the primes, would likely oppose them.

Outsource to Allies

A final pathway for procurement reform is for the DOD to expand defense-industrial collaboration with allies and partners. The United States has several allies that can provide heavy industrial capabilities. For example, Germany is good at artillery production and South Korea at armored vehicle and diesel submarine production. Buying weapons, platforms, and munitions from allies off the shelf, or with limited modifications, would provide significant cost savings over starting new programs in the United States. Especially in shipbuilding, adding foreign yards to the US system would increase production capacity far faster than any investment in domestic production alone. For example, French- or British-built corvettes and frigates could integrate easily into the US fleet.[81] Israeli and even Ukrainian-produced drones and EW tools might find a useful place as well. There are also many other possibilities, described in more detail in chapters 8 and 9.

The most prominent single obstacle to this approach is the thicket of US regulations surrounding international defense manufacturing partnerships. Under the Arms Export Control Act (AECA) of 1976, the president can designate what should be considered regulated defense-

related goods and services, placing them on the US Munitions List. In practice, however, International Traffic in Arms Regulations (ITAR) is overseen by the State Department's Directorate of Defense Trade Controls, as the DOD has no direct oversight. ITAR regulations were written vaguely to allow for adaptability.[82] In practice, the system has become a bureaucratic morass. ITAR makes it hard to export US defense technology and share the data and specifications that foreign producers would need to build defense articles competitively for the US market.

Initial steps toward ITAR reform have accomplished little. In 2022, the State Department announced changes to align some ITAR rules with rules for dual-use goods, which are enforced by the Commerce Department's Bureau of Industry and Security. However, these were incremental updates, not systemic reforms. State tends to be cautious about enforcing the rules and lacks specialist expertise in the technologies being shared.[83] Export and collaboration requests are typically approved after years of processing and review, which deters collaboration on smaller and shorter-term projects and in areas where technology is advancing quickly. Foreign suppliers can provide lower-tech items such as simpler munitions, land vehicles, small warships, and conventionally powered submarines, but in general ITAR is the main legal impediment to building a shared DIB with allies.[84]

The Australia-UK-US (AUKUS) partnership has put ITAR in the spotlight. It makes little sense to impose ITAR rules on exports to Australia and the United Kingdom, since the entire purpose of AUKUS was to remove this red tape.[85] In May 2024, the State Department granted exemptions to 70 percent of the goods categorized in the ITAR for UK and Australian companies. However, key products remain on the Excluded Technologies List, including cluster munitions and UUV signature reduction techniques. Precision strike missiles and UAVs are also subject to the Missile Technology Control Regime (MTCR), which further impairs cooperation.[86] ITAR exemptions need to be broadened further. Otherwise, progress on the AUKUS

agreement, which includes coproducing a new generation of attack submarines, could fall badly behind schedule.

ITAR has also been a particular barrier to deepening cooperation with Japan in missile production and space-related technologies.[87] As Lockheed Martin Vice President Eric Brown has complained: "Seemingly no one can definitively identify who is empowered to say 'yes' below the [level of a four-star general or admiral]—but anyone can seemingly say 'no.' This decision authority factors into ITAR decisions."[88] A review of space technology export controls is currently ongoing.[89] Defense industrial cooperation with Japan requires scrutiny since Japan lacks a counterintelligence apparatus to guard against espionage risks. Washington should pressure Tokyo to start building that apparatus now and provide support and advice in the process.

Even when ITAR authorizes defense articles to be exported, many products are subject to onerous extraterritorial jurisdiction rules, which can make companies in allied countries apprehensive about procuring them. ITAR rules use expansive definitions of fundamental terms like "articles" or "services." Altogether, these incentives build in a bias toward legacy systems, since emerging technologies come with more regulatory risk. In addition to disincentives to trade, these issues have led to many delays in key equipment, including for Navy and Air Force repair work to US assets in Australia and during the air campaigns in Iraq and Syria.[90]

Given the urgency of US procurement shortfalls, comprehensive ITAR reform is essential.[91] Reforming ITAR must be done carefully, given the risks that an overly permissive regime would allow US adversaries to gain access to sensitive technologies. Still, operationalizing reform ought to be straightforward. The president could set the process in motion by issuing an executive order instructing the State, Defense, and Commerce Departments to harmonize and streamline export controls processes and procedures for a list of close allies and partners. Bipartisan congressional support will also be crucial to enable comprehensive ITAR reform. International and corporate partners will want assurances that future presidents will not

reinterpret existing ITAR rules to meddle with ongoing projects, such as AUKUS.[92]

In addition to ITAR, a raft of import restrictions and related bureaucracy stands in the way of the "outsource to allies" approach to DIB expansion. The import of foreign defense articles operates under a separate regulatory framework from ITAR. For allied-produced munitions and technology entering the US market, the Directorate of Defense Trade Controls (DDTC) maintains the US Munitions Import List (USMIL), with the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF) handling import permissions through Form 6 processes.[93] Allied manufacturers must navigate multiple regulatory frameworks, including the Export Administration Regulations (EAR), Committee on Foreign Investment in the United States (CFIUS) reviews, and Defense Federal Acquisition Regulation Supplement (DFARS) requirements.[94] In addition, the Buy American Act and similar procurement policies prioritize US-made products, though exceptions exist through Reciprocal Defense Procurement memoranda of understanding and National Technology and Industrial Base (NTIB) considerations.[95] Some allied companies enter the US market by establishing US-based subsidiaries under Special Security Arrangements (SSAs), which allow foreign-owned entities to work on US defense contracts provided they meet stringent security and compliance requirements.[96] As touched on above, ITAR can indirectly affect imports through technical data requirements and registration requirements for importers dealing with ITAR-controlled items. In general, however, outsourcing to allies for a wider range of defense articles will require paring down some existing protections for US incumbents.

The key barrier here is congressional politics. Elected officials tend to support defense spending because it creates jobs in their states and districts. Shifting to a model where the United States buys high-value systems from other countries will require US legislators to recognize that the urgency of the deterrence challenge in the Western Pacific is an exceptional circumstance. It will also require them to resist lobbying

pressure from US incumbents, who will push hard against reforms that expose them to international competition.[97] Domestic constituencies have blocked past attempts at ITAR reform, and it seems unlikely that meaningful change will occur without bipartisan consensus.[98] The argument for outsourcing more to allies is ultimately partially strategic: It serves US national interests if allied countries can maintain robust DIBs, can defend themselves, and can contribute meaningfully wherever their defense interests overlap with those of the United States.

Conclusion

The only way to fix the DIB is to reform it *and* recapitalize it—on top of the existing US defense budget. There is no silver bullet solution. Reform to the PPBE and JCIDS processes will not resolve the problem of industrial undercapacity. Executive action alone cannot force industry to solve the problem at its own expense. A VC model cannot replace existing production chains in the medium term. Allied countries cannot meet the demand without ITAR reform and heavy investments in their own industrial bases. ITAR reform is necessary, but slashing red tape indiscriminately would increase the risk of adversaries acquiring sensitive technology. In this context, over the medium term Congress should provide the strongest political mandate it can, and the DOD must explore each of these approaches at once.

With respect to Little A, the DOD should commit either to a centralized procurement model that significantly reduces the power of individual services or to a decentralized model that grants the services full control over procurement and force structure. In the very long run, the decentralized approach is probably the optimal solution for the Indo-Pacific. To discourage the services from duplicating each other's programs, OSD should take responsibility for translating programmatic developments between the services, particularly in critical areas like hypersonics. This will require bringing more specialized

business experience into the DOD, particularly OSD. In all cases, the DOD will need to maintain close partnerships with major defense providers, since they may need to purchase or partner with smaller defense technology companies to scale up production of innovative new technologies.

Creating an international vetting mechanism will allow US and foreign defense industry professionals and engineers to discuss programmatic developments openly without bureaucratic interference, fostering global collaboration. Contracting with foreign yards for small surface combatants can alleviate domestic production pressures, while funding multiyear contracts for all major systems, especially long-range missiles, will provide stability and predictability. Setting up smaller yards to produce, repair, and overhaul submarines and smaller warships would reduce the strain on larger yards and enhance the DIB's overall efficiency and resilience.