

# The U.S. Defense Industrial Base: Past Strength, Current Challenges, and Needed Change

Maiya Clark

The United States faces threats from its rivals and from rogue actors, and it maintains a military of land, sea, air, and space forces to counter those threats. This *Index of U.S. Military Strength* provides analysis of those military forces' adequacy. The military, however, is only the most visible element of national defense; beneath the surface, a much larger industrial capacity serves to undergird that military power.

This industrial capacity—the defense industrial base—consists of the government-owned and privately owned factories, foundries, shipyards, and ammunition plants that produce defense end items. It also includes the businesses and government institutions that produce those items, from prime contractors with hundreds of thousands of employees and billions of dollars in annual revenue down to small businesses that make individual components for larger defense systems and innovators that create new technologies, whether startups with defense-relevant emerging tech or academia and research universities. The defense industrial base also includes the workforce that powers this sector.

In the past, U.S. industrial might as a whole underwrote U.S. military strength and success. Manufacturing underpinned the national economy. When urgent national security threats emerged, leaders prioritized defense investments, and private industry and government facilities responded to this demand signal—accomplishing incredible feats like producing nearly 300,000 aircraft and 86,000 tanks in World War II.<sup>1</sup> Industry could respond because latent production capacity already existed, either for defense-specific items or for commercial items that could be converted to defense production.

Government capabilities existed as a result of previous wartime mobilizations.

Today, America's national defense remains just as dependent on the nature of its economy; those ties, however, do not make the U.S. as secure as they once did. The U.S. economy is now based primarily in knowledge and services: Manufacturing accounted for only 8.7 percent of U.S. jobs in 2015, compared to 32 percent in 1953.<sup>2</sup>

Despite the current deficiencies in the defense industrial base, leaders in Congress and the executive branch have not yet chosen either to increase federal funding for defense or to make the difficult trade-offs (such as cutting entitlement spending) that would be necessary under such an increase to enable a restoration of this key capability.

The global threat environment is growing more hostile as the economic and cultural factors that historically have supported U.S. military strength decline. Not only have manufacturing and key industrial processes moved overseas, but—even worse—they have moved to China, America's chief rival. The U.S. is in a “new Cold War” with China even as the two countries' economies are deeply intertwined.

U.S. military strength therefore cannot rely on the economic conditions and assumptions of the past—those conditions no longer exist, and any attempt to recreate them would require heavy government intervention in the economy with all of the inefficiencies and injustices that such intervention entails. Rather, leaders must pursue the development of a strong U.S. military and resilient defense industrial base within today's economic environment, utilizing innovative policies to ensure that

defense production can meet America's demands in today's changing security environment.

### History of U.S. Defense Production

The U.S. has produced defense items since before the American Revolution. Though this could hardly be called an "industrial base," as it predates industrialization, the U.S. produced weapons and built ships for the Revolutionary War and the War of 1812. The earliest defense industries in the U.S. based their businesses around arming the combatants of imperial wars in Europe.<sup>3</sup> Then, during the American Civil War, the North's superior defense production capacity contributed in a major way to its eventual victory.<sup>4</sup>

The U.S. produced weapons that were eventually used in World War I, but because it lacked defense-specific production capacity, by the time its industry was able to produce items like tanks and artillery pieces, the war was nearly over. For example, although poison gas was first used in the war in 1915, when the U.S. joined the fight in 1917, the Army could still not produce its own gas masks and instead had to borrow respirator equipment from British and French forces.<sup>5</sup>

The first real test of U.S. defense industrial capacity was World War II. In the years before the war, the U.S. had developed a great deal of manufacturing capacity, as well as latent capacity, as a result of policies that were designed to mitigate the Great Depression. The U.S. also had a large workforce and plentiful available labor for the same reason. While this industrial capacity was not being used for defense production at the time, political and business leaders saw that the war unfolding in Europe in 1939 and 1940 would require much more participation from the United States. Leaders in the auto industry in particular saw that their manufacturing capacity would need to be mobilized for wartime production. Both allies and the U.S. government sharply increased their purchases of defense goods, from aircraft to uniforms. Industry responded to this surge in demand for defense goods by converting their commercial manufacturing capacity for items like washing machines and record players to the production of war matériel.<sup>6</sup>

The relatively unsophisticated nature of the matériel being produced meant that manufacturing capacity for consumer goods could shift to war production fairly easily. Military Jeeps were just trucks,

and bombs were merely steel and explosives. Even more complex end items like planes were made of components that could be produced in commercial factories: For example, Frigidaire, an electric refrigerator manufacturer, produced propellers, hydraulic aircraft controls, and machine guns for combat aircraft.<sup>7</sup>

The combination of factors that allowed the U.S. to mobilize successfully for World War II would continue to define U.S. defense industrial capacity for most of the rest of the 20th century. A large domestic industrial capacity in general, and a large defense industrial base in particular, combined with the will of political and business leaders and a commitment to spending and contracts for defense to produce an Allied victory.

The same framework held true for much of the Cold War: The U.S. continued to be a manufacturing powerhouse through much of the 20th century, and the U.S. defense industry consistently outmatched that of the Soviet Union for technological supremacy. Leaders also recognized the importance of defense during this time because the threat of the Cold War becoming a hot war with the Soviet Union was often foremost in the American consciousness (schoolchildren practiced sheltering under their desks in the event of nuclear attack, for example). There was a clear adversary against whom the United States had to arm itself.

Leaders also spent significant amounts of federal funds on defense: Defense spending reached 10 percent of GDP and higher during the 1950s and climbed again to 8.6 percent at the height of the Vietnam War and 5.7 percent during the Reagan defense buildup of the 1980s.<sup>8</sup> The combination of industrial capacity, strategic focus and political will, and federal dollars allocated to defense allowed the U.S. to compete during—and eventually win—the Cold War.

With the fall of the Soviet Union in 1991, the U.S. entered a period of relative geopolitical stability in which it was the world's only remaining great power. Without a clear national security threat, the U.S. lacked the strategic focus that had defined the Cold War and the World War II era before it. Defense spending dwindled during this "unipolar" era, and the U.S. defense industrial base responded by consolidating and shrinking. During the same period, the nature of the global economy began to change. Commercial manufacturing increasingly

moved overseas as firms aimed to take advantage of lower labor costs in developing countries. In 1960, foreign consumer goods accounted for 8 percent of Americans' purchases, but they accounted for 60 percent in 2010.<sup>9</sup>

These changes are understandable given the conditions of the time. The U.S.'s lack of strategic focus during this era is explainable because there seemed to be no clear threats to U.S. national interests as there were during the Cold War. Some reductions in defense spending made sense during this era as leaders sought to capitalize on a post-Cold War "peace dividend." The move of manufacturing overseas was the natural consequence of economic conditions at the time. Unfortunately, all three of these trends are still visible in the makeup of the defense industrial base today in ways that leave the United States less secure.

### Defense Production Today

The defense industry in the United States today reflects both the legacy of World War II and the legacy also of the 1990s and 2000s.

**Defense Production Capacity.** The U.S. defense industry has atrophied. Prime contractors have consolidated from 51 firms down to five.<sup>10</sup> While this consolidation does not necessarily indicate a smaller defense industry, the broader ecosystem of defense subcontractors and suppliers has also shrunk: In the past five years alone, the defense sector has lost a net 17,045 companies.<sup>11</sup> The number of people employed in defense-related work has shrunk by two-thirds, from 3 million workers in 1985 to 1.1 million in 2021.<sup>12</sup>

Reduced defense spending during the 1990s and early 2000s drove some of this consolidation. In a 1991 meeting now known colloquially as the "Last Supper," then-Secretary of Defense Les Aspin informed the CEOs of the major defense prime contractors that the U.S. government would be spending less on defense, that the firms could not expect to do the same amount of business that they had done during the Cold War and especially during the 1980s defense buildup, and that they should consider consolidating in order to survive.<sup>13</sup> During this era, mergers and acquisitions (M&A) activity transformed the defense industry, particularly at the prime contractor level, leaving only a handful of firms performing work for which dozens of firms had previously competed.

**The Broader Economy.** Beyond the defense industry, the nature of the American economy is very different from what it was in the World War II era. Many of these changes have been the natural result of market forces, but they have negative implications for national security.

The U.S. is no longer primarily a manufacturing or industrial economy. In 1950, manufacturing jobs accounted for 33.7 percent of U.S. employment; today, they account for only 8.4 percent of employment.<sup>14</sup> This shift has profound implications for defense production. The nation was able to mobilize domestic manufacturing capacity to produce matériel for World War II, but far less latent manufacturing capacity is available today.

In addition, the modern economy is globally interconnected to a degree that would be hard for businessmen of the 1940s to imagine. A car assembled in South Carolina is likely made of components manufactured in dozens of other countries, and those components likely contain raw materials sourced from dozens of other countries as well. This interconnectedness means that mobilization of U.S. production will depend on suppliers based in myriad other countries—countries that may not have an interest in helping the U.S. increase its defense production or may even have an active interest in stopping it.

The U.S. economy is not just globally interconnected; as opposed to the Cold War era when the nation was relatively able to operate independently, it is heavily reliant on its chief rival and pacing threat. China is the top supplier of imported goods to the U.S.,<sup>15</sup> produces 78 percent of rare earths imported by the U.S.,<sup>16</sup> and produces 10 times as much steel and more than 40 times as much aluminum as the U.S. produces.<sup>17</sup>

While manufacturing capacity for defense goods and manufacturing capacity writ large are not the same thing, manufacturing capacity and capabilities can still potentially be mobilized over time to fill defense manufacturing needs. However, defense systems are far more complex than they were 80 years ago. An F-35 is closer to a flying supercomputer than it is to a World War II fighter aircraft.

Another problem in U.S. society today is that not all firms that are able to perform defense-related work have workforces whose ideologies completely align with the national security interests of the United States; in some cases, they do not feel that working with the U.S. military serves their

interests or aligns with their values. For example, in 2018, more than 4,000 Google employees signed a letter protesting the company’s involvement in Project Maven, which used artificial intelligence to improve drone strike targeting. In response, Google adopted a set of ethical principles governing its use of AI technology that forbade its participation in weapons or surveillance programs.<sup>18</sup> Other firms have demonstrated an unwillingness to have their products used for military purposes: Elon Musk’s StarLink satellite system, for example, has imposed periodic limitations on the use of its services in Ukraine.<sup>19</sup>

**Leaders’ Commitment to Defense.** Defense industrial strength in the past required political will and leadership just as much as it required industrial capacity. Today, Members of Congress and consecutive presidential Administrations have recognized that China poses the greatest threat to U.S. national security. The 2018 and 2022 National Defense Strategies both acknowledged this threat and made it the chief focus of U.S. strategy. Congress similarly has focused its rhetoric and even some of its legislative authority on the China challenge.

Rhetoric is largely ahead of defense spending, however. The defense budget as appropriated by Congress has grown since 2015, but not in a way that would indicate a fundamental shift to renewed great-power competition.

Three presidential Administrations have struggled to shift the U.S. strategic focus to the Indo-Pacific. The Department of Defense (DOD) uses what it calls a “sizing construct” to determine the size and types of forces that are needed to maintain America’s defense. When the Obama Administration announced its “Pacific pivot,” the DOD also shifted from the decades-old force sizing construct of being able to meet two “major regional contingencies” (MRCs) to a “one-plus” MRC construct—a shift that diminished capacity rather than increasing it. The DOD’s force sizing construct drives its war planning scenarios, and these scenarios in turn inform the military’s requirements process, determining the amount of manpower and equipment that each service will need.

There is reason to suspect that budget is driving national security strategy rather than strategy driving budget in the DOD. The public has little visibility into DOD war planning scenarios—which can be a good thing; such information should be

protected—but the limited information available seems to indicate that stockpiles of weapons, munitions, and raw materials are inadequate. Within two months of Russia’s invasion, the U.S. had sent a third of its Stinger missiles and a quarter of its Javelin missiles to Ukraine.<sup>20</sup> If those amounts of stocks are consumed that quickly in what (compared to a contest with a near-peer competitor) is a regional war, it is hard to imagine that those munitions reserves will be sufficient for potential wartime needs.

### What the Threat Environment Requires

The U.S. has entered a new era of great-power competition with China. This competition—characterized by The Heritage Foundation as a “new Cold War”—exists across multiple domains, from the economy to freedom of navigation.

The domain of greatest concern in this discussion, however, is military competition. China has modernized its military in the past decades. It has exceeded the United States in certain categories like hypersonics. Through espionage and intellectual property theft, China has stolen technologies that are found in the F-22 and F-35 aircraft and incorporated them into its own fifth-generation fighter aircraft, the J-20.<sup>21</sup> The People’s Liberation Army Navy (PLAN) has more battle force ships than the U.S. Navy, and its battle force “is expected to grow to 420 ships by 2025 and 460 ships by 2030.”<sup>22</sup>

The China threat requires that the U.S. bolster its own defense capabilities and ensure the capabilities of its allies in the region. An early step will be to facilitate the arming of Taiwan with modern weapons to deter a Chinese invasion or to fight China if deterrence fails. At current U.S. production rates, however, Taiwan will not receive the weapons it needs in the necessary time frame.

More generally, there is a sense that the DOD’s planning scenarios do not account for the realities of war with and deterrence of China. In such a situation, the DOD must honestly assess global threats, the DOD and the executive branch must use that information to develop a force structure that mitigates risk and a budget that pays for it, and the legislative branch must appropriate the necessary funding.

### Acquisition as National Security

In the past, acquisition decisions have attempted to balance effectiveness, cost, and time. Today,



however, acquisition also needs to account for the current, diminished state of the defense industrial base with a goal of not only purchasing matériel in the short term, but also developing a greater capacity to produce that matériel over the long term.

**Spending Money to Get Capacity.** The U.S. has been buying defense systems at essentially peacetime levels for decades, and the resulting industrial base cannot now support the demands of great-power competition. To create needed manufacturing capacity, the DOD must sign longer-term contracts with industry for key platforms and munitions. These contracts will necessarily cost more and must specify requirements for industry to be able to surge production for future requirements, and DOD must periodically validate industry's ability to do so. This accomplishes both the obvious goal of procuring those items and the subtler objective of building the capital equipment, facilities, and workforce that are necessary to continue producing those items. Developing manufacturing capacity takes years: Better to begin now than to wait until war begins.

The DOD needs to begin thinking beyond simply procuring items it needs. Far more attention must be paid to developing and maintaining production capacity. The ability to manufacture key defense items is a good, separate from the good of the defense items themselves. The U.S. needs the ability to surge production of munitions, fighter aircraft, and ground vehicles in addition to possessing these items themselves in order to be safe. Contracts will have to reflect this by requiring contractors to maintain certain latent production capacity, which will likely make those contracts more expensive.

To increase defense production capacity while minimizing the burden on the U.S. taxpayer—and to better arm our allies—the U.S. should encourage more Foreign Military Sales (FMS). Currently, the FMS process is structured for peacetime and involves lengthy bureaucratic processes. These delays are severe enough that allies have recently chosen to buy their weapons systems elsewhere. For example, Poland recently chose to buy tanks from South Korea instead of the U.S.<sup>23</sup> Both the State Department and the DOD have announced new changes aimed at accelerating slow FMS processes with new internal deadlines for key processes; special expedited treatment in cases involving direct U.S. defense interests (arming Taiwan, for example);

and a new “FMS Continuous Process Improvement Board” reporting to the Secretary of Defense.<sup>24</sup>

The greatest cause of FMS delays, however, is a lack of capacity in the defense industrial base. To remedy that, more aggressive contracting strategies that require contractors to increase capacity and deliver faster will be needed.

**Identifying Specific Risks.** Beyond the general issue of limited defense manufacturing capacity, different specific risks exist in the supply chains for different acquisition programs. Ensuring a strong industrial base will require strategic thinking, in addition to investment, to mitigate these risks. Currently, policymakers' understanding of these issues is largely anecdotal. The American public knows about 155 mm shells, Javelins, and Stingers only because the war in Ukraine “pulled the sheets off the bed.”

There is no routine mechanism for policymakers to understand these risks. Even the DOD's own annual industrial base reports (publication of which the Biden Administration has delayed for years despite annual publication being required by law) are unhelpful because they have anecdotal information but no metrics. Without better assessment of industrial base vulnerabilities, efforts to strengthen the industrial base will be immethodical and potentially wasteful of scarce resources.

One risk that currently impacts defense production is the DOD's lack of supply chain visibility. The DOD cannot address problems it does not understand. Supply chain visibility refers to the ability of the customer (the DOD in this case) and the prime contractor to “see” clearly into the lowest tiers of their supporting supply chains.

In the current acquisition system, no single actor has full visibility into supply chains for defense programs. The DOD delegates this responsibility to prime contractors, and prime contractors typically follow the government's example and include supply chain management in their contracts with their first-tier subcontractors, extending their knowledge only one layer deep. Those subcontractors follow suit in their contracts with second-tier subcontractors and so on down the chain. As a result, prime contractors usually understand their supply chains only down through the first few tiers; beyond that, they trust their subcontractors to manage their subcontractors and so on.

Greater visibility into defense supply chains would reveal current risks like dependence on

China for raw materials and even certain components. As a case study, in September 2022, the DOD halted deliveries of Lockheed Martin's F-35 after finding that a cobalt and samarium alloy used in magnets for the plane's turbomachine pumps was made in China. The DOD discovered this violation only after Lockheed Martin was notified by Honeywell (the maker of F-35 turbomachines), which was told by its lube pump supplier, which was told by its magnet supplier that the firm had used an alloy manufactured in China in violation of DOD acquisition regulations.<sup>25</sup>

In this case, dependence on China carried a significant yet comparatively small cost: delayed deliveries of a vital defense system while a new, compliant supplier was found. However, similarly imperfect knowledge of defense supply chains extends across the entire defense industrial base and carries huge risk. If the U.S. went to war with China, economic ties between them would be completely severed. The Pentagon would quickly learn which defense components were made in China because contractors suddenly would not have access to them. Production of key weapons could grind to a halt at a time when those weapons are desperately needed.<sup>26</sup>

Another common supply chain vulnerability is single-source suppliers for defense system components. In many cases, there is only one company making a subsystem or component for a defense system. This creates potential choke points in manufacturing capacity: For example, an aircraft manufacturer may have more capacity to increase production in its final assembly plant, but its limiting factor on production is a sub-tier supplier's limited capacity to produce landing gear assemblies.

A lack of redundancy also makes the supply chain more fragile: If a sole-source supplier is no longer able to produce a given component, it can shut down production for the entire system. A good example of this risk is the explosion that occurred at the U.S.'s only black powder mill in Minden, Louisiana. The plant was offline for two years after the explosion occurred, forcing contractors to draw from black powder stockpiles in order to produce the munitions that use black powder to ignite more powerful explosives.<sup>27</sup> Again, what makes these situations all the more dangerous is that the DOD normally does not understand its own vulnerability until a problem develops—and then it is too late to address it.

The DOD needs better visibility into the defense industrial base with a greater understanding of the supply chains that link the entire ecosystem in order to mitigate risk. Fortunately, there are tools today to gather, maintain, and analyze this information (such as artificial intelligence and even blockchain technology) that did not exist in earlier eras of U.S. defense production. These data tools should be applied to a risk management framework that assesses both the probability of a defense supply chain disruption and how consequential such a disruption would be. With more granular information, the DOD could better target its limited resources to areas of the defense industrial base that require the most urgent attention.

**Mitigating Risk.** Vulnerabilities in the defense industrial base should be mitigated in ways that account for the unique facets of each sector, and even each acquisition program, and the particularities of their weaknesses. However, just as there are common threads linking all these defense industrial base vulnerabilities, there are common mitigations that can make up a “tool kit” for defense policymakers.

One important type of tool is multiyear and block-buy contracting. Whereas typical procurement processes require the DOD to use a contract for each year's purchases, multiyear procurement authorities allow the DOD to buy and commit funding for up to five years' worth of an item in one contract with penalties to the government if it breaks this purchase commitment. These longer-term commitments give contractors the stability they need to invest in facilities and workforce. Multiyear contracts also generate savings for the government because optimizing production over a longer-term period creates efficiencies. Multiyear and block-buy contracts should be used more often to reap these benefits.

Another, more interventionist tool is Title III of the Defense Production Act (DPA), which grants authority to the President to “create, maintain, protect, expand, or restore domestic industrial base capabilities” using funds allocated specifically for that purpose. These authorities have been used to incentivize businesses to enter the defense space or to expand their capabilities and have served both to create domestic production capabilities for items typically procured from overseas and to strengthen the fragile domestic supply base.<sup>28</sup>

For example, in 2020, the DOD announced multiple DPA Title III funding awards to domestic rare earth element producers to expand their mining and refining capacity, thereby creating a more secure supply chain for defense applications of these materials. More recently, President Biden used DPA authorities to build up domestic hypersonic weapons manufacturing capacity. Such tools have value for very urgent national defense needs, but should be used only when market forces and DOD procurement practices are unable to generate the necessary conditions for a particular defense industrial production capability.

**An Acquisition Strategy for a New Era.** Today, acquisition success is measured according to three variables: cost, schedule, and performance. A fourth factor—resilience—must be added to this paradigm. The terms of every defense contract should take into account the risks to production of that platform or munition. For certain items, they should also require the contractor to maintain surge production capacity; facilities should no longer be optimized to produce the exact amount required for immediate needs and should instead have built-in

latent capacity. The DOD (and Congress) should spend the extra money required to maintain that surge capacity, and the new emphasis on resilience should be taught to the acquisition workforce through training at Defense Acquisition University.

## Conclusion

The story of allied victory in WWII—and of U.S. military superiority in the decades that followed—in addition to the great feats of arms, can also be understood in terms of U.S. industrial might: the strength of its defense industrial base, undergirded by a thriving manufacturing economy and defense-focused leadership. Because those economic and political conditions do not exist today, the defense industrial base is not well-positioned for a new era of great-power competition.

Improving defense industrial performance does not mean recreating former economic and political conditions. It means working within conditions today and leveraging new technology to strategically grow and strengthen targeted U.S. defense industrial capacity.

## Endnotes

1. PBS, "The War: War Production," <https://www.pbs.org/kenburns/the-war/war-production#:~:text=American%20industry%20provided%20almost%20two,world's%20largest%2C%20doubled%20in%20size> (accessed August 11, 2023).
2. YiLi Chen and Paul Morris, "Is U.S. Manufacturing Really Declining?" Federal Reserve Bank of St. Louis, On the Economy Blog, April 11, 2017, <https://www.stlouisfed.org/on-the-economy/2017/april/us-manufacturing-really-declining> (accessed October 16, 2023).
3. Olivia B. Waxman, "The Inside History of How Guns Are Marketed and Sold in America," *Time*, August 19, 2022, <https://time.com/6207280/gun-industry-us-history/> (accessed August 11, 2023).
4. Benjamin T. Arrington, "Industry and Economy During the Civil War," National Park Service, last updated August 23, 2017, <https://www.nps.gov/articles/industry-and-economy-during-the-civil-war.htm#:~:text=The%20Union's%20industrial%20and%20economic,mobilization%20of%20resources%20more%20difficult> (accessed August 11, 2023).
5. Jeffrey K. Smart, Command Historian, Historical Research and Response Team, Aberdeen Proving Ground, *History of the Army Protective Mask*, U.S. Army Soldier and Biological Chemical Command, August 1, 1999 (accessed August 11, 2023). The date of publication is specified on the U.S. Department of Defense, Defense Technical Information Center website, <https://apps.dtic.mil/sti/citations/ADA376445> (accessed August 11, 2023).
6. For more information on World War II mobilization, see Arthur Herman, *Freedom's Forge: How American Business Produced Victory in World War II* (New York: Random House, 2012). In *Freedom's Forge*, Herman writes at length throughout the book about the frictions and conflicts—alongside some occasions of collaboration—between free market industrialists at the center of America's automotive, construction, and general manufacturing sectors and the politicians and organized labor leaders surrounding (and heavily influencing) Franklin Delano Roosevelt in the late 1930s and early 1940s. As war raged in Europe and the western Pacific, automotive giant William Knudson, of Ford Motor Company and General Motors Corporation, and Henry J. Kaiser, who got his start in building roads, dams, and bridges, and who would later construct massive shipyards, saw the potential of underutilized capacity in laborers, construction firms, and a disparate array of manufacturing concerns financed by the Roosevelt Administration to provide paid work for Americans displaced from the labor market by the Great Depression. Knudson and Kaiser recognized that only free market capitalism, with its ingenuity spurred by the opportunity to make a profit while also contributing to the nation's defense, had the ability to quickly, and efficiently, convert idle factories to massive wartime production. FDR's advisors and supporters saw opportunity to entrench organized labor and centralized government control by exploiting the same wartime demand signal. Fortunately for the U.S. and the free world, the free marketers were able to circumvent the worst intentions of big government proponents, resulting in the unleashing of heretofore unimaginable industrial power that enabled the free world to win World War II.
7. Video, "These People (1944) World War II, Frigidaire, General Motors," Retro Video Vault, <https://www.youtube.com/watch?v=KnUfKrMxce8> (accessed August 11, 2023).
8. Graphic, "Defense Spending as a % of Gross Domestic Product (GDP)," U.S. Department of Defense, <https://www.defense.gov/Multimedia/Photos/igphoto/2002099941/> (accessed August 11, 2023).
9. Bradley Blackburn and Eric Noll, "Made in America: A Brief History of U.S. Manufacturing," ABC News, February 14, 2011, <https://abcnews.go.com/Business/made-america-middle-class-built-manufacturing-jobs/story?id=12916118> (accessed August 11, 2023).
10. U.S. Department of Defense, Office of the Under Secretary of Defense for Acquisition and Sustainment, *State of Competition Within the Defense Industrial Base*, February 2022, p. 1, <https://media.defense.gov/2022/Feb/15/2002939087/-1/-1/1/STATE-OF-COMPETITION-WITHIN-THE-DEFENSE-INDUSTRIAL-BASE.PDF> (accessed August 11, 2023).
11. National Defense Industrial Association, "Vital Signs 2023: Posturing the U.S. Defense Industrial Base for Great Power Competition," February 2023, p. 5, [https://www.ndia.org/-/media/sites/ndia/policy/vital-signs/2023/ndia\\_vitalsigns2023\\_final\\_v3.pdf](https://www.ndia.org/-/media/sites/ndia/policy/vital-signs/2023/ndia_vitalsigns2023_final_v3.pdf) (accessed August 11, 2023).
12. Ibid.
13. U.S. Department of Defense, Office of the Under Secretary of Defense for Acquisition and Sustainment, Office of Industrial Base Policy, *Fiscal Year 2020 Industrial Capabilities Report to Congress*, January 2021, p. 174, note 3, <https://media.defense.gov/2021/Jan/14/2002565311/-1/-1/0/FY20-INDUSTRIAL-CAPABILITIES-REPORT.PDF> (accessed August 11, 2023).
14. Katelynn Harris, "Forty Years of Falling Manufacturing Employment," U.S. Department of Labor, Bureau of Labor Statistics, *Beyond the Numbers*, Vol. 9, No. 16 (November 2020), [https://www.bls.gov/opub/btn/volume-9/forty-years-of-falling-manufacturing-employment.htm#\\_edn2](https://www.bls.gov/opub/btn/volume-9/forty-years-of-falling-manufacturing-employment.htm#_edn2) (accessed August 11, 2023).
15. Executive Office of the President, Office of the United States Trade Representative, "Countries & Regions," <https://ustr.gov/countries-regions> (accessed August 11, 2023).
16. Daniel J. Cordier, "Rare Earths," U.S. Geological Survey, Mineral Commodity Summaries, January 2022, <https://pubs.usgs.gov/periodicals/mcs2022/mcs2022-rare-earth.pdf> (accessed August 11, 2023).
17. Andrew F. Krepinevich Jr., *Protracted Great-Power War: A Preliminary Assessment*, Center for a New American Security, America Competes 2020, February 2020, p. 37, [https://s3.us-east-1.amazonaws.com/files.cnas.org/documents/CNAS-Report\\_Defense-Great-Power-War-DoS-Proof-B.pdf?mtime=20200204133208&focal=none](https://s3.us-east-1.amazonaws.com/files.cnas.org/documents/CNAS-Report_Defense-Great-Power-War-DoS-Proof-B.pdf?mtime=20200204133208&focal=none) (accessed August 11, 2023).
18. Daisuke Wakabayashi and Kate Conger, "Google Wants to Work with the Pentagon Again, Despite Employee Concerns," *The New York Times*, updated November 5, 2021, <https://www.nytimes.com/2021/11/03/technology/google-pentagon-artificial-intelligence.html> (accessed August 11, 2023).



19. Joey Roulette, "SpaceX Curbed Ukraine's Use of Starlink Internet for Drones—Company President," Reuters, February 9, 2023, <https://www.reuters.com/business/aerospace-defense/spacex-curbed-ukraines-use-starlink-internet-drones-company-president-2023-02-09/> (accessed August 11, 2023).
20. Mark F. Cancian, "Will the United States Run Out of Javelins Before Russia Runs Out of Tanks?" Center for Strategic and International Studies *Commentary*, April 12, 2022, <https://www.csis.org/analysis/will-united-states-run-out-javelins-russia-runs-out-tanks> (accessed August 11, 2023).
21. Wendell Minnick, "Chinese Businessman Pleads Guilty of Spying on F-35 and F-22," *Defense News*, March 24, 2016, <https://www.defensenews.com/breaking-news/2016/03/24/chinese-businessman-pleads-guilty-of-spying-on-f-35-and-f-22/> (accessed August 11, 2023).
22. U.S. Department of Defense, Office of the Secretary of Defense, *Annual Report to Congress: Military and Security Developments Involving the People's Republic of China 2021*, p. 49, quoted in Dean Cheng, "China," in *2023 Index of U.S. Military Strength*, ed. Dakota L. Wood (Washington: The Heritage Foundation, 2023), p. 202.
23. Blake Herzinger, "South Korea Could Sweep up Europe's Tank Market," *Foreign Policy*, January 30, 2023, <https://foreignpolicy.com/2023/01/30/south-korea-europe-k2-tanks-defense-partnerships-germany/> (accessed August 11, 2023).
24. Daniel Wilson, "DOD Unveils Overhaul to Foreign Military Sales Process," Law360, June 14, 2023, <https://www.law360.com/aerospace/articles/1688424> (accessed August 9, 2023), and Fact Sheet, "FMS 2023: Retooling Foreign Military Sales for an Age of Strategic Competition," U.S. Department of State, May 18, 2023, <https://www.state.gov/fms-2023-retooling-foreign-military-sales-for-an-age-of-strategic-competition/> (accessed August 11, 2023).
25. Stephen Losey, "Pentagon Suspends F-35 Deliveries over Chinese Alloy in Magnet," *Defense News*, September 7, 2022, <https://www.defensenews.com/air/2022/09/07/pentagon-suspends-f-35-deliveries-over-chinese-alloy-in-magnet/> (accessed August 11, 2023).
26. An example of one foreign-made component's ability to delay an entire program could be seen in the F-35 program when the Republic of Turkey was removed from the program. For more about this, see Maiya Clark, "Understanding and Protecting Vital U.S. Defense Supply Chains," Heritage Foundation *Backgrounder* No. 3598, April 1, 2021, p. 2, <https://www.heritage.org/sites/default/files/2021-04/BG3598.pdf>.
27. Gordon Lubold, "The U.S. Military Relies on One Louisiana Factory. It Blew Up," *The Wall Street Journal*, April 26, 2023, <https://www.wsj.com/articles/the-u-s-military-has-an-explosive-problem-6e1a1049> (accessed August 11, 2023). Production of black powder was restarted in June 2023, after Estes Energetics purchased the facility from Hodgdon Powder Company in January 2022 and rebuilt the manufacturing capability. See American Rifleman Staff, "Hodgdon Closes GOEX Blackpowder Plant," *American Rifleman*, September 28, 2021, <https://www.americanrifleman.org/content/hodgdon-closes-goex-blackpowder-plant/> (accessed October 18, 2023), and Estes Industries, "Estes Energetics Restarts Shipment of GOEX Black Powder," *GlobeNewswire*, September 8, 2023, <https://www.globenewswire.com/news-release/2023/09/08/2739981/0/en/Estes-Energetics-Restarts-Shipment-of-GOEX-Black-Powder.html> (accessed October 18, 2023).
28. *Ibid.*, p. 11.