

MARCH 2024

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REBUILDING THE ARSENAL OF DEMOCRACY

The U.S. and Chinese Defense Industrial Bases in an Era of
Great Power Competition

AUTHORS

Seth G. Jones
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A REPORT OF THE

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ISBN: 978-1-5381-7076-2 (pb); 978-1-5381-7077-9 (eBook)

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and International Studies
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Washington, DC 20036
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Lanham, MD 20706
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ACKNOWLEDGMENTS

The authors owe a huge debt of gratitude to numerous individuals whose help was critical during the research, writing, editing, and publication phases of this report. Thanks to Riley McCabe, Mackenzie Holtz, and Delaney Duff at CSIS for their outstanding research assistance. In addition, thanks to several individuals for their comments and discussions on early drafts, such as John Hamre, Eric Heginbotham, Jacob Cohn, Cynthia Cook, Greg Sanders, Jerry McGinn, Louis Lauter, Sean Monaghan, Laura Brent, and Mark Weber. A wide range of individuals from Congress, industry, the executive branch, and U.S. allies and partners also provided comments, critiques, and suggestions that were extraordinarily helpful in improving the quality of this report.

The authors and their colleagues at CSIS also held public discussions on the defense industrial base and related topics with several senior Department of Defense officials, such as Under Secretary of Defense for Acquisition and Sustainment William LaPlante; Assistant Secretary of the Army for Acquisition, Logistics, and Technology Douglas Bush; Assistant Secretary of Defense for Industrial Base Policy Laura Taylor-Kale; Deputy Under Secretary of Defense for Acquisition and Sustainment Radha Iyengar Plumb; Commandant of the U.S. Coast Guard Admiral Linda Fagan; and Vice Chairman of the Joint Chiefs of Staff Christopher Grady. Thanks also to several allies and partners, including public discussions with UK First Sea Lord and Chief of the Naval Staff Admiral Sir Ben Key and Commander of the Royal Canadian Navy Vice-Admiral Angus Topshee. Thanks also to the insights on various aspects of China and the People's Liberation Army over the last year from Victor Cha, Bonny Lin, Jude Blanchette, Chris Johnstone, Lily McElwee, and Charlie Edel.

More broadly, this report would not have been possible without the extensive assistance and expertise of numerous individuals from the U.S. government (especially the Departments of Defense and State), several members of Congress and their staff, industry executives, and subject-matter experts. Most of them did not want to be identified by name, but this report could not have been written without their insights.

Finally, thanks to CSIS's outstanding iLab and External Relations teams for their help in editing, formatting, and publishing the document. They include Lauren Adler, Sam Cestari, Emma Colbran, Bridget Corna, Julia Huh, Alex Kisling, Jeeah Lee, Phillip Meylan, Rayna Salam, and Katherine Stark.

This report is made possible by general support to CSIS. No direct sponsorship contributed to this report.

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ABBREVIATIONS

AMRAAM – Advanced Medium-Range Air-to-Air Missile

C2 – Command and control

C4ISR – Command, control, communications, computers, intelligence, surveillance, and reconnaissance

CCP – Chinese Communist Party

CR – Continuing resolution

DCS – Direct Commercial Sales

DDTC – Directorate of Defense Trade Controls

DSCA – Defense Security Cooperation Agency

FMS – Foreign Military Sales

GLMRS – Guided Multiple Launch Rocket System

HIMARS – High Mobility Artillery Rocket System

ICBM – Intercontinental ballistic missile

IRBM – Intermediate-range ballistic missile

ISR – Intelligence, surveillance, and reconnaissance

ITAR – International Traffic in Arms Regulations

JASSM – Joint Air-to-Surface Standoff Missile

JPAC – Joint Production Accelerate Cell

LEO – Low Earth orbit

LOA – Letter of offer and acceptance

LOR – Letter of request

LRASM – Long Range Anti-Ship Missile

MRBM – Medium-range ballistic missile

NDAA – National Defense Authorization Act

NDAC – National Defense Advisory Committee

NTIB – National Technology and Industrial Base

PAC – Patriot Advanced Capability

PLA – People’s Liberation Army

PLAA – People’s Liberation Army Ground Force

PLAAF – People’s Liberation Army Air Force

PLAN – People’s Liberation Army Navy

PLARF – People’s Liberation Army Rocket Force

PLASSF – People’s Liberation Army Strategic Support Force

PrSM – Precision Strike Missile

RDP – Reciprocal defense procurement

RORO – Roll-on/roll-off

SM – Standard Missile

SRBM – Short-range ballistic missile

STEM – Science, technology, engineering, and mathematics

TLAM – Tomahawk land-attack missile

TSFD – Technology Security and Foreign Disclosure

UAS – Unmanned aircraft system

“I want to make it clear that it is the purpose of the nation to build now with all possible speed every machine, every arsenal, every factory that we need to manufacture our defense material. . . . We must be the great arsenal of democracy. For us this is an emergency as serious as war itself. We must apply ourselves to our task with the same resolution, the same sense of urgency, the same spirit of patriotism and sacrifice as we would show were we at war.”

– *Franklin Delano Roosevelt*¹

EXECUTIVE SUMMARY

The U.S. defense industrial base—including the executive branch, Congress, and defense companies—lacks the capacity, responsiveness, flexibility, and surge capability to meet the U.S. military’s production needs as China ramps up defense industrial production. Unless there are urgent changes, the United States risks weakening deterrence and undermining its warfighting capabilities against China and other competitors. A significant part of the problem is that the U.S. defense ecosystem remains on a peacetime footing, despite a protracted war in Ukraine, an active war in the Middle East, and growing tensions in the Indo-Pacific in such areas as the Taiwan Strait and Korean Peninsula.

The United States faces several acute challenges.

First, the Chinese defense industrial base is increasingly on a wartime footing and, in some areas, outpacing the U.S. defense industrial base. Most open-source research and analysis on the U.S. defense industrial base has been conducted in a vacuum and has not systematically assessed China’s defense industrial base. Chinese defense companies, such as China North Industries Group Corporation Limited and the Aviation Industry Corporation of China, are producing a growing quantity and quality of land, maritime, air, space, and other capabilities. China increased its defense budget by 7.2 percent in 2024 and is heavily investing in munitions and acquiring high-end weapons systems and equipment five to six times faster than the United States, according to some U.S. government estimates. China is now the world’s largest shipbuilder and has a shipbuilding capacity that is roughly 230 times larger than the United States. One of China’s large shipyards, such as Jiangnan Shipyard, has more capacity than all U.S. shipyards combined, according to U.S. Navy estimates.

Second, the U.S. defense industrial base continues to face a range of production challenges, including a lack of urgency in revitalizing the defense industrial ecosystem. The U.S. Department of Defense has taken some helpful steps to strengthen the industrial base, such as developing a National Defense Industrial Strategy, increasing production for some weapons systems, and pushing for multiyear procurement. But there is still a shortfall of munitions and other weapons systems for a protracted war in such areas as the Indo-Pacific. Supply chain challenges also remain serious, and today’s workforce is inadequate to meet the demands of the defense industrial base.

Third, the United States has not sufficiently leveraged its relationships with allies and partners, though it has taken some steps

through such arrangements as the Australia–United Kingdom–United States (AUKUS) partnership. Nevertheless, there are too many bureaucratic hurdles and inefficiencies in the Foreign Military Sales (FMS) program, International Traffic in Arms Regulations (ITAR), and other policies and procedures. Co-development, co-production, co-sustainment, and other forms of cooperation between the United States and its closest allies and partners have been stifled. While the current National Defense Strategy notes that U.S. defense strategy needs to be “anchored” in allies and partners, the United States has fallen short in defense industrial base cooperation with its friends.

There are multiple reasons for these challenges. One is that the U.S. defense industrial base is much bigger than any one agency or department. The Department of Defense, Department of State, Department of Commerce, Department of the Treasury, Congress, the private sector, and other organizations play important roles in the industrial base. But they often have different interests and priorities. In addition, there is significant political and bureaucratic resistance to reforming the defense industrial base and broader defense ecosystem. Some areas of the executive and legislative branches remain too risk averse in sharing sensitive technology with allies and partners. Others mistakenly see a revitalization of the defense industrial base as giving money to greedy executives engaged in waste, fraud, and abuse.

Moving forward, the United States needs to take several steps to revitalize the defense industrial base and broader ecosystem in an increasingly dangerous world.

White House–Led Initiative: There is an urgent need for the U.S. president to create a body that provides strategic guidance and helps oversee a revitalization of the defense industrial base. Revitalization will not occur without White House leadership, as the history of the U.S. defense industrial base demonstrates. During major crises in U.S. history, such as World War II and the Cold War, presidential leadership was essential. Presidents Franklin Delano Roosevelt, Harry Truman, Dwight D. Eisenhower, Ronald Reagan, and others were pivotal in providing the leadership, strategic vision, organization, and funding to revitalize the defense industry. One option is a variant of the production boards that existed during the Roosevelt and Truman administrations. Such a body could be established by the U.S. president and exercise

general direction over U.S. defense procurement and production; help determine the policies, plans, and procedures of federal departments regarding defense procurement, production, arms sales, and technology transfers; establish priorities in the distribution of materials and services; fix bureaucratic problems; incentivize industry; improve communication with industry; and, perhaps most importantly, provide a sense of urgency.

Defense Spending: The United States likely cannot revamp its defense industrial base without additional spending on the development and production of weapons systems necessary for deterrence and warfighting. During the Cold War, the U.S. defense budget was between 9 and 11 percent of GDP during the Eisenhower administration, between 8 and 9 percent during the Kennedy and Johnson administrations, and over 6 percent during the Reagan administration. Today’s defense budget of roughly 3 percent of GDP is not consistent with a security environment in which authoritarian states, such as China, Russia, Iran, and North Korea, are threatening the United States and its allies and partners across the globe. Without an increase in funding for the development and production of weapons systems, it will be virtually impossible to revitalize the defense industrial base to compete with China.

Multiyear Contracting: The Department of Defense and Congress need to expand the use of multiyear procurement to create sustained demand signals that will promote investment in the defense industrial base. Congressional appropriators need to fund—and the military services need to spend—a wider range of munitions important for warfighting and deterrence in the Indo-Pacific, Europe, and Middle East. Multiyear procurement is important to build a consistent and predictable demand signal that creates more transparency and less risk for prime contractors and more fragile sub-tier suppliers.

Strategic Stockpiles: The Department of Defense and Congress should allocate additional funding for contracts and other incentives

(such as tax incentives, regulatory relief, and long-term contracts) to build and maintain surge production capacity. This funding can be used to modernize and expand facilities and develop flexible production. The Department of Defense maintains stockpiles of key munitions, minerals, chemicals, technology, and medical supplies, but it needs to better manage inventory and stockpile planning to decrease near-term risk.

Workforce and Supply Chains: The United States needs to create the conditions that diversify the supplier base for the defense industry and invest in new production methods. The Department of Defense should look for opportunities to assist companies with upskilling and reskilling workers by offering incentives, such as expanding investments in the Manufacturing Innovation Institutes and in programs designed to support the talent necessary for defense-related manufacturing and science, technology, engineering, and mathematics jobs.

Allies and Partners: The White House—or a White House-appointed body—needs to focus increased attention on streamlining FMS and Direct Commercial Sales (DCS) review policies and procedures, as well as support co-development, co-production, and other types of arrangements with allies and partners. The Department of Defense should develop a more efficient review process for releasing technology, accelerate acquisition and contracting assistance, and ensure broad U.S. government support to improve the FMS process. The Defense Security Cooperation Agency, working with the services and military departments, should establish a rapid contracting process to reduce the backlog in getting approved FMS cases on contract. The administration should move quickly to put in place regulations that will provide broad exemptions for the United Kingdom and Australia, much like the United States

has provided to Canada. In addition, the U.S. government should increase co-production, co-development, and other arrangements with key allies and partners in such areas as munitions, shipbuilding, and ground vehicles.

These steps are important to strengthen the U.S. defense industrial base in a competitive security environment. In his “Victory Speech” in December 1940, one year before Pearl Harbor, President Franklin Delano Roosevelt implored the nation to revitalize its defense industry. It is a message that is just as relevant today. “We must be the great arsenal of democracy,” Roosevelt said. “For us this is an emergency as serious as war itself. We must apply ourselves to our task with the same resolution, the same sense of urgency, the same spirit of patriotism and sacrifice as we would show were we at war.”¹



CHAPTER 01

INTRODUCTION



**Used artillery shell casings
at a former gun position at an
unspecified location in Ukraine**

SOURCE Scott Peterson/Getty Images

Growing international competition between the United States and China, Russia's invasion of Ukraine, war in the Middle East, and increasing tensions on the Korean Peninsula have raised questions about the state of the U.S. defense industrial base. Does the United States have sufficient capacity and flexibility in its defense industrial base for deterrence and warfighting? If not, what else needs to be done? These questions are particularly important since the structure of the international system has changed over the past decade from one of unipolarity, where the United States had no major peers, to one centered on Washington and Beijing. In addition, military capabilities are rapidly evolving in such areas as robotics, sensors, artificial intelligence, cyber, space, long-range precision strike, hypersonics, and advanced communications, command, and control.

For some, the U.S. defense industrial base is adequate for today and tomorrow. As one U.S. Department of Defense report concludes, "the defense industry is financially healthy, and its financial health has improved over time."¹ Other analysts and policymakers contend that the United States' capacity is more than sufficient to deter or win a war against another major power such as China. The United States enjoys significant economic and production advantages over its competitors, this argument goes, and "the overall picture is one of stability and health, not decline" in the defense industry.² Others argue that the push to increase defense production is largely due to lobbying by defense companies, not military requirements.

As one assessment concludes, increased investment in the defense industry “would require a permanent expansion of U.S. weapons manufacturing capability. And once the new factories exist, there will be pressure to keep them open in perpetuity, at a cost of untold billions of dollars.”³ Indeed, some see defense revitalization as wasting taxpayer money and increasing the possibility of waste, fraud, and abuse.⁴ Five U.S. senators—Bernie Sanders (D-VT), Elizabeth Warren (D-MA), Ron Wyden (D-OR), Charles Grassley (R-IA), and Mike Braun (R-IN)—wrote in a letter to U.S. secretary of defense Lloyd Austin in May 2023 that some defense companies were “dramatically overcharging the Department and U.S. taxpayers while reaping enormous profits, seeing their stock prices soar, and handing out massive executive compensation packages.”⁵

Research Design

To better understand the U.S. defense industrial base, this report asks several questions: What is the state of China’s defense industrial base? In light of growing competition with China and other international contingencies, how

Table 1.1 Example of Differences between Commercial and Defense Markets

Source Jacques S. Gansler, *Democracy’s Arsenal: Creating a Twenty-First Century Defense Industry* (Cambridge, MA: MIT Press, 2011), 282.

prepared is the U.S. defense industrial base for deterrence and warfighting over the next five years? What steps should the United States take to establish a more effective defense industrial base?

To answer these questions, this report adopts a mixture of qualitative and quantitative methods. It compiles and analyzes a range of data to better understand the U.S. and Chinese industrial bases, including in such areas as the defense sector and maritime, air, land, and missile capabilities. The report collects and analyzes other types of information, including White House–led defense bodies since World War II (such as the National Defense Advisory Committee and the War Production Board) and U.S. defense spending as a percentage of GDP since World War II. The report also utilizes information from interviews with a wide range of individuals from the Department of Defense, Department of State, Congress (both members and staff), defense companies, and other subject-matter experts. Finally, this report incorporates qualitative information from both primary and secondary sources, including on the history of the U.S. defense industrial base.

| ASPECTS | COMMERCIAL MARKETS | DEFENSE MARKETS |
|------------------|---|---|
| Products | Technology that is often quickly applied | Technology that is often gradually applied |
| Market Structure | Numerous buyers and producers | One domestic buyer, large and exquisitely engineered items that are often purchased in small quantities |
| Demand | Competitive and can vary depending on price, quality, and other factors | Monopsonistic; less price sensitive |
| Supply | Competitive and adapts to demand | Oligopolistic |
| Entry and Exit | Substantial movement of firms into and out of the market | Significant barriers to entry and exit |
| Prices | Impacted by market competition | Regulated |
| Outputs | Impacted by market competition | Decided by government |

The defense industrial base is a subset of the broader economy and includes the set of companies involved in the research, development, design, production, delivery, and maintenance of weapons systems.



As used here, the defense industrial base is a subset of the broader economy and includes the set of companies involved in the research, development, design, production, delivery, and maintenance of weapons systems.⁶ Defense is not a free market system. It is a monopsony, a market arrangement in which there are several suppliers but only one buyer.⁷ Defense is also a government-regulated industry, not a government-managed one. Government auditors monitor the costs, purchases, and profits of defense contractors. In the United States, congressional investigations have led to volumes of binding regulations—which are often cumbersome and inefficient—that contractors must follow if they are to remain eligible to work on defense projects.⁸ Table 1.1 highlights several rough differences between the commercial and defense markets. However, a substantial number of companies are hybrid, with an increasing share of their revenue coming from commercial sales.

Organization of the Report

The rest of this report is divided into three chapters. Chapter 2 analyzes China's defense industrial base (including Chinese defense

companies) with a focus on the military capabilities produced by the Chinese defense industry and some of China's defense-related weaknesses and operational challenges. Chapter 3 examines the strengths and weaknesses in the U.S. defense industrial base, including in such areas as presidential-level support, defense production, and cooperation with allies and partners. Chapter 4 offers policy recommendations.



CHAPTER 02

CHINA'S DEFENSE INDUSTRIAL BASE AND CAPABILITIES



A ship building and repair base in Qingdao, China

SOURCE NurPhoto/Getty Images

This chapter examines China's defense industrial base and Chinese military capabilities. It concludes that China's defense industrial base is moving to a wartime footing, which means that China is rapidly developing and producing weapons systems and preparing to fight a war against another major power, particularly the United States. As U.S. secretary of the Air Force Frank Kendall III put it, "China is preparing for a war and specifically for a war with the United States."¹ Great power wars have historically been won by those nations or coalitions that can outbuild, outspend, outmobilize, and outfight their adversaries.² Both modern history and the ongoing war in Ukraine demonstrate that the ability to produce more arms and equipment is crucial for a nation at war. There is little reason to believe that a war between China and the United States would be different, and the relative strengths of their defense industrial bases is therefore a key factor in strategic competition.

Strengthening China's defense industrial base is one part of China's broader strategy of competition. Chinese leaders have articulated a long-term national strategy to achieve the "great rejuvenation of the Chinese nation on all fronts" by 2049, including developing a "world-class" military.³ Along these lines, China is focused on outperforming the United States and other countries in the research, development, production, and innovation of information technologies and weapons systems, all of which are central to the future of warfare.⁴ In addition, China's research, acquisition, and production processes and capabilities are

China's defense industrial base is moving to a wartime footing, which means that China is rapidly developing and producing weapons systems and preparing to fight a war against another major power, particularly the United States.



improving.⁵ The People's Liberation Army (PLA) has poured vast resources into capitalizing on the growing capabilities of artificial intelligence, big data, advanced computing, 5G, and supporting military and dual-use technologies. The PLA is developing advanced weapons systems, such as stealth and hypersonic capabilities. In addition, the PLA is amassing a formidable and ever-expanding arsenal of medium- and long-range precision missiles capable of striking U.S. and partner land, air, and sea bases. The PLA is also building a dense web of integrated air defense systems to challenge U.S. forces attempting to operate near such areas as the Taiwan Strait.

Overall, trends in military production suggest that China is closing the gap with the United States, though China falls short of the United States on several measures of military power discussed at the end of this chapter. As highlighted in Table 2.1 later in this chapter, China has almost 50 percent more military personnel and twice as many active ground and paramilitary forces as the United States, can take advantage of its large fleet of smaller missile-armed watercraft in fighting near its shores, and operates nearly twice as many main battle tanks and 50 percent more artillery systems than the United States. Although the size of its stockpiles and its rate of production are unclear, China may also have a preponderance of cruise missiles, given the emphasis the PLA places on their use in a conflict with the United States.

The rest of this chapter is divided into seven sections. The first examines China's defense sector, including a comparison of U.S. and Chinese military capabilities. The next four sections analyze Chinese maritime, air, land, and missile capabilities. The sixth assesses Chinese defense industrial weaknesses. The final section explores operational challenges for China.

Defense Sector

China's rise as a global economic power has made it the preeminent Indo-Pacific military power next to the United States, even with China's recent economic challenges in such areas as the country's property crisis, rising unemployment (including youth unemployment), and rapidly aging population.⁶ Estimated Chinese defense spending has accounted for at least 2 percent of GDP for the past 30 years, but China's GDP and defense spending have both increased nearly ninefold during that time.⁷ In March 2024, China announced a 7.2 percent increase in its defense budget to continue modernizing its armed forces and strengthen its defense industrial base.⁸

The impact of China's rise on the regional balance of power has been dramatic. China's neighbors have not come close to matching its level of spending, as seen in Figure 2.1. Although the United States still spends more on defense than China, the gap is narrowing. Twenty years ago, U.S. military spending was nine times that of China. Last year, it was less than three times as much.⁹ The gap is narrower than it looks. The United States has global commitments, while China can focus far more on its immediate neighborhood.

China's defense industry has grown along with its military spending. As shown in Figure 2.2, four of the world's ten largest defense companies are now Chinese enterprises. China's biggest defense companies have been growing even larger, but the market has been expanding in other ways, with smaller defense contractors

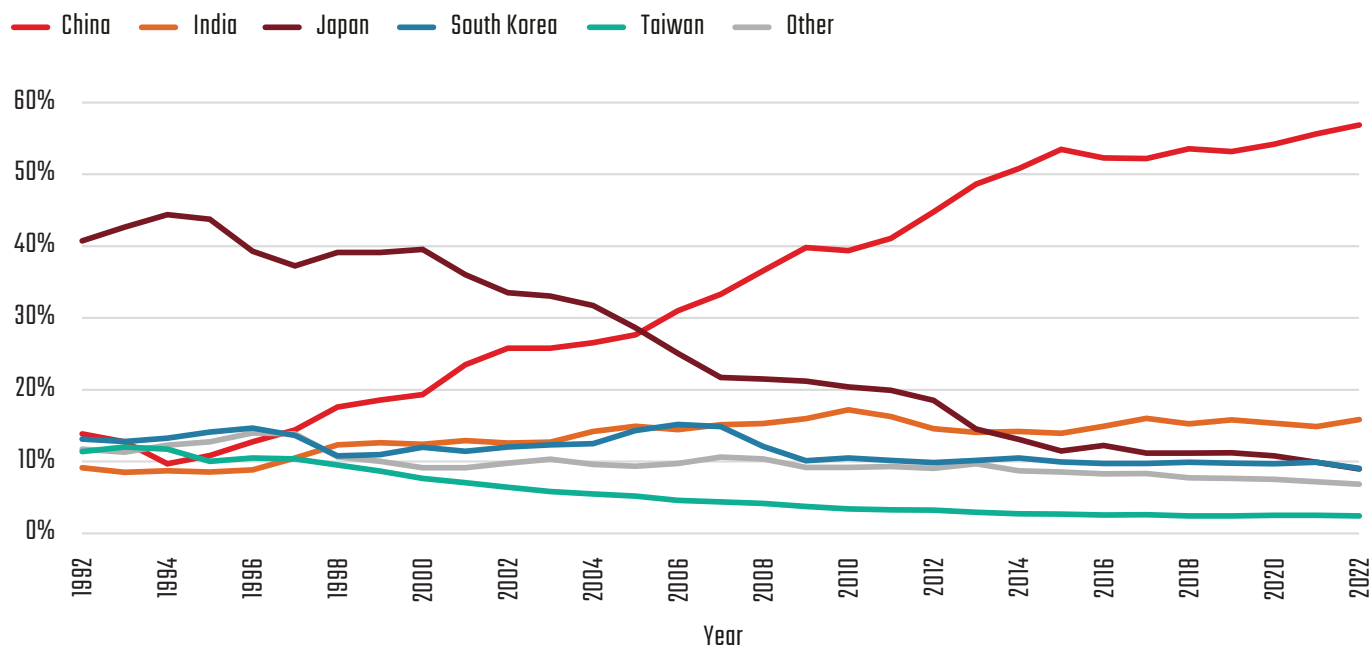


Figure 2.1 Share of Indo-Pacific Defense Spending by Country

Note Vietnam, North Korea, Myanmar, and Timor Leste are excluded due to lack of data.

Source "SIPRI Military Expenditure Database," Stockholm International Peace Research Institute, <https://doi.org/10.55163/CQGC9685>.

growing more numerous. China has taken what one U.S. government assessment calls a set of "unprecedented steps to facilitate the entry of private firms into the defense industrial base."¹⁰ That assessment identified 183 private Chinese companies that contributed goods or services to defense aviation and aerospace, 108 of which had ties to the Chinese Communist Party (CCP) or PLA that could give them access to advantages not typically available to private commercial entities.¹¹ The CCP has undertaken significant steps to grow its defense industrial base, a key driver of military power.

China's defense industrial potential is probably even higher than its military spending and domestic defense industries suggest. China has adopted a strategy of military-civil fusion (军民融合), promoting coordination between and integration of military and civilian industry, economies, and systems.¹² Many

technologies produced by its civilian sectors have clear military applications, and the CCP is likely seeking to exploit these technologies.¹³ China has built military requirements into the construction of civilian infrastructure and sought ways to use civilian construction and logistics for military purposes.¹⁴ Commercial Chinese unmanned aircraft systems (UASs) have been used in Ukraine in large numbers.¹⁵ The PLA has experimented with using civilian roll-on/roll-off watercraft (commonly referred to as "ROROs") in an invasion of Taiwan, conducting several exercises to develop the necessary doctrine and skills.¹⁶ Chinese companies have also dramatically increased their orders of these ROROs for 2024 and 2025, likely heralding a major expansion in construction.¹⁷ The military implications of any one of these developments are unclear, but China's defense industrial capacity is likely even greater than it appears on the surface.

China has also improved its defense acquisition system. Over the past decade, the PLA has markedly enhanced its research, development, and acquisition (RDA) process. This progress has allowed the PLA to produce advanced platforms in such difficult areas as carrier-based aviation, hypersonics, and propulsion systems.¹⁸ China's RDA process appears to have five general steps: feasibility study, project design, engineering and development, experiment and design finalization, and batch production (if a system passes all of these stages).¹⁹ According to one U.S. defense

Over the past decade, the PLA has markedly enhanced its research, development, and acquisition (RDA) process.

official, it takes China less than seven years, on average, to deliver an operational capability, compared to 16 years for the United States.²⁰ As an analysis of the Chinese defense acquisition system concludes, “Given sufficient time and money, the Chinese RDA system is capable of producing innovative and sophisticated weapons. It is capable of devoting massive resources toward ambitious, priority projects over very long periods, resulting in incremental progress and eventual achievement of its goals.”²¹

The Chinese system has several advantages over the U.S. system, as well as some disadvantages discussed later in the chapter. The government’s centralized power and

decisionmaking process help drive whole-of-government strategies. By linking the defense budget to GDP, China can reliably forecast and plan future defense spending. China’s military-civil fusion allows the state to direct university-based research to prioritized science and technology areas.²² China also places multiple bets in defense research and development by funding numerous concepts, choosing winners, and producing systems and platforms in large numbers.²³

Table 2.1 provides an overview of U.S. and Chinese capabilities in such areas as the defense sector and maritime, air, land, and missile capabilities. In addition to these categories, China has also focused on building its network-centric warfare capabilities to fight a joint campaign against the United States. For example,

Figure 2.2 The 10 Largest Defense Companies Globally by Total Revenue, 2022
Source “Top 100 for 2023,” Defense News, accessed October 17, 2023, <https://people.defensenews.com/top-100/>.

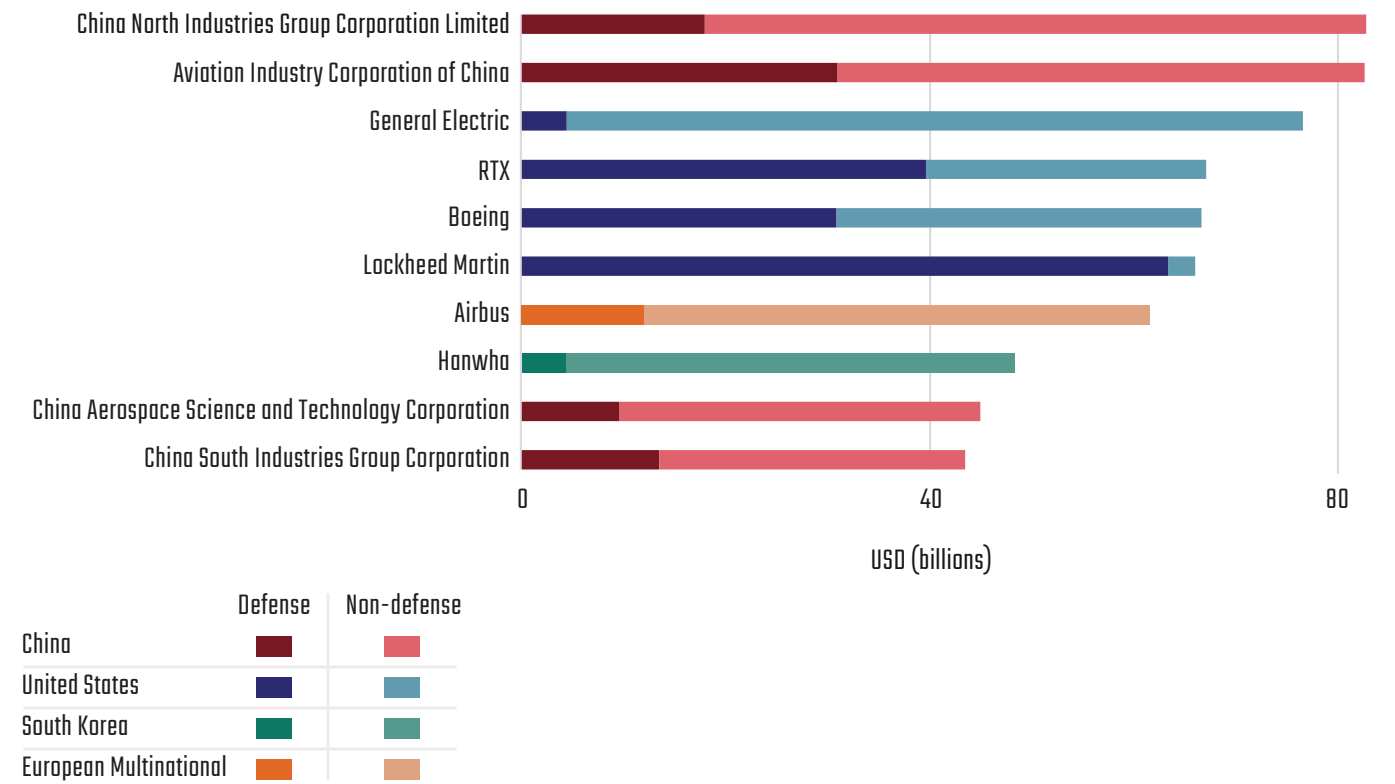


Table 2.1 Chinese and U.S. Military Capabilities

Note Principal surface combatants were defined as aircraft carriers, cruisers, destroyers, frigates, and corvettes.

Source Hans M. Kristensen et al., “Chinese Nuclear Weapons, 2024,” *Bulletin of the Atomic Scientists* 80, no. 1 (January 2, 2024): 49–72, <https://doi.org/10.1080/00963402.2023.2295206>; Hans M. Kristensen and Matt Korda, “United States Nuclear Weapons, 2023,” *Bulletin of the Atomic Scientists* 79, no. 1 (January 2, 2023): 28–52, <https://doi.org/10.1080/00963402.2022.2156686>. “SIPRI Military Expenditure Database,” Stockholm International Peace Research Institute, 2023, <https://doi.org/10.55163/CQ6C9685>; Stockholm International Peace Research Institute, “World Military Expenditure Reaches New Record High as European Spending Surges,” Press release, April 24, 2023, <https://www.sipri.org/media/press-release/2023/world-military-expenditure-reaches-new-record-high-european-spending-surges>; Office of the Secretary of Defense, *Military and Security Developments Involving the People’s Republic of China*; and International Institute for Strategic Studies (IISS), *The Military Balance 2024* (London: Routledge, 2024), <https://www.routledge.com/The-Military-Balance-2024/for-Strategic-Studies-IISS/p/book/9781032780047>.



the PLA has developed a concept called “multi-domain precision warfare” (多域精确战). The operational concept is designed to leverage a command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) network; rapidly coordinate firepower using artificial intelligence, big data, and other emerging technologies; and identify and exploit U.S. vulnerabilities.²⁴ China has also made advances in other areas, including space and cyber.²⁵ Taken together, China’s production of major combat assets like ships and planes—as well as its creation of the concepts and supporting infrastructure necessary to fight a twenty-first-century adversary—suggest a military and industrial base increasingly prepared for conflict with the United States.

| CATEGORY | VARIABLE | CHINA | UNITED STATES |
|----------------|---|--|--|
| Defense Sector | Absolute defense spending | \$292 billion | \$877 billion |
| | Defense spending as a percentage of GDP | 1.60% | 3.50% |
| | Military personnel | 2,035,000 (2,545,000 including reserves) | 1,326,050 (2,132,750 including reserves) |
| Maritime | Principal surface combatants (hulls) | 151 | 122 |
| | Principal surface combatants (tons displacement) | 781,850 | 2,026,499 |
| | Total vertical launch system cells (surface and subsurface) | 4,296 | 9,922 |
| | Nuclear attack submarines | 6 | 52 |
| | Diesel attack submarines | 46 | 0 |
| | Total subsurface displacement | 240,216 | 708,935 |
| Air | Fifth-generation aircraft | 200 | 816 |
| | Fourth-generation aircraft | 1,865 | 2,536 |
| | Bomber aircraft | 209 | 140 |
| Land | All active ground forces personnel | 1,000,000 | 623,550 |
| | Combined arms brigades / brigade combat teams | 75 | 24 (51 including reserves) |
| | Main battle tanks | 4,700 | 2,640 |
| | Other armored fighting vehicles | 6,304 | 11,137 |
| | Artillery systems | 9,722 | 6,443 |
| Missiles | Land-based ballistic warheads | 346 | 800 |
| | Submarine-launched ballistic warheads | 72 | 1,920 |
| | Air-launched ballistic warheads | 20 | 988 |
| | Road-mobile ballistic launchers | 601 (298–350 nuclear-capable) | 0 |
| | Silo-based nuclear launchers | 6 | 400 |
| | Nuclear ballistic missile submarines | 6 | 14 |
| | Nuclear-capable bombers | 12–20 | 66 |

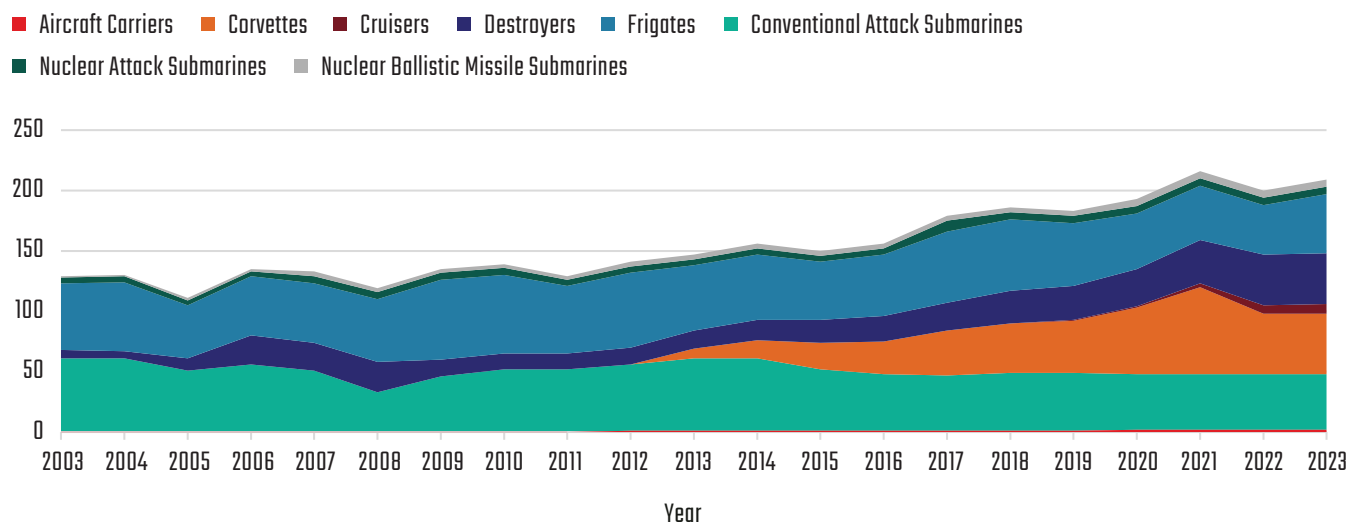


Figure 2.3 Principal Surface and Subsurface Combatants Operated by the PLAN

Source: Data sourced from the 2004–2024 editions of the International Institute for Strategic Studies' *The Military Balance*.

Maritime

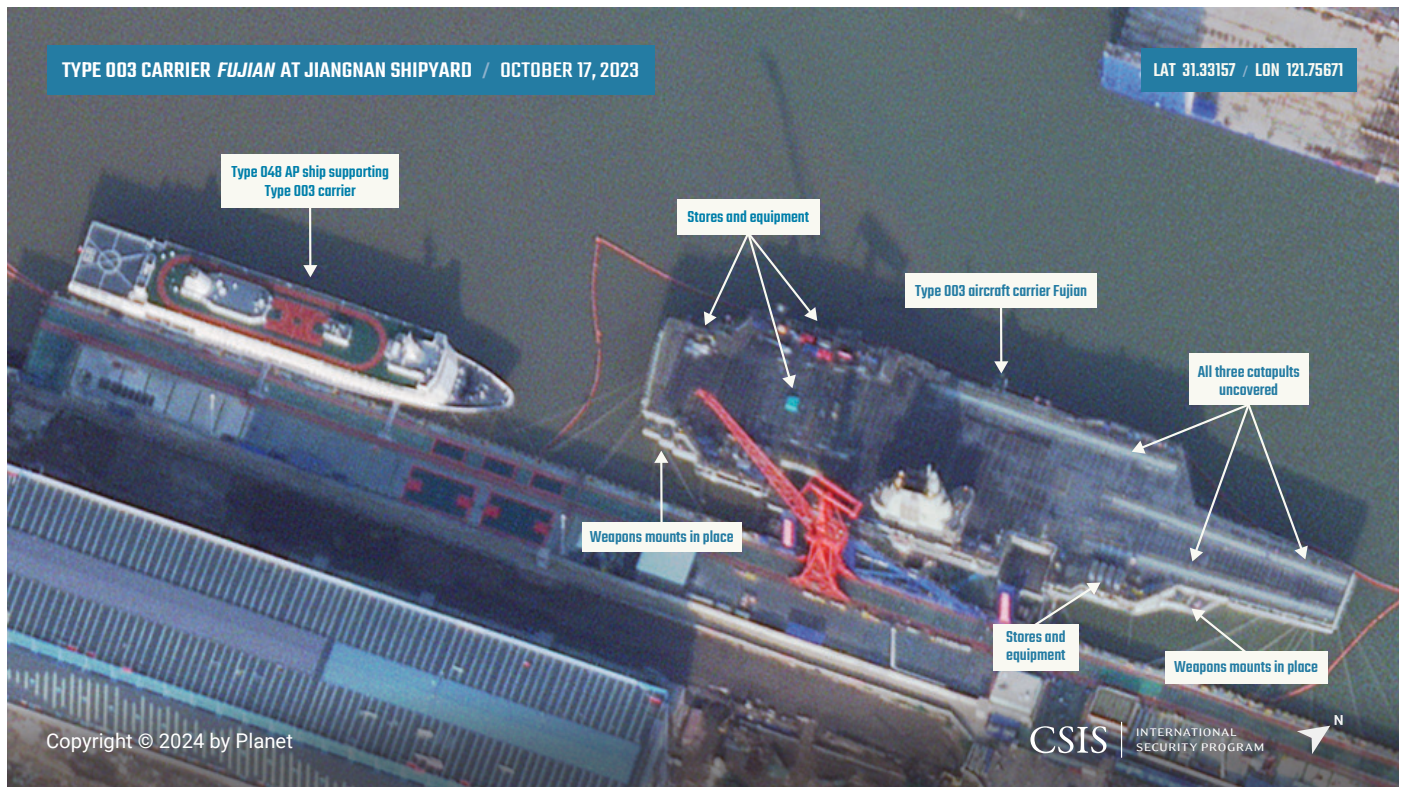
The main beneficiary of China's defense industrial growth has been the People's Liberation Army Navy (PLAN), especially through a growth in China's shipbuilding capabilities. China's ability to rapidly build large numbers of ships represents a possible advantage in a protracted war in the Indo-Pacific.²⁶ China is now the world's largest shipbuilder by a significant margin. It has a shipbuilding capacity that is more than 230 times larger than that of the United States and sufficient to build 23 million tons of vessels compared to less than 100,000 tons in the United States.²⁷ According to U.S. Navy estimates, a single Chinese shipyard currently has more capacity than all U.S. shipyards combined.²⁸ The PLAN's growth has made it the largest navy in the world. But the U.S. Navy likely remains more capable by most measures, including physical indicators like tonnage or Vertical Launch System (VLS) cells and operational competencies such as anti-submarine warfare, joint operations, and long-range targeting.²⁹

As shown in Figure 2.3, the PLAN has been growing larger since at least 2006, with increases coming in notable categories: the steady increase in corvette construction since 2014, the completion of the Type 002 aircraft carrier

Shandong (山东) and the Type 003 carrier *Fujian* (福建舰) in 2017 and 2022 respectively, and the construction of eight Type 055 destroyers (designated by NATO as a cruiser) since 2019.³⁰ Some of these ships will grow the Chinese fleet, but others will be swapped with older comparable systems, modernizing the PLAN without increasing its size. However, the overall trend is toward greater size and capability.

The PLAN still trails the U.S. Navy in other indicators of military might. China may have more ships than the United States, but they are smaller.³¹ The aggregate displacement of the PLAN's surface warships is a little more than a third that of the U.S. Navy. The PLAN is also capable of carrying roughly half as many missiles as the U.S. Navy, indicating a relative disadvantage in firepower.³²

That said, both gaps are closing, and China would have the advantage of fighting close to its borders in a conflict in the Taiwan Strait or South or East China Seas, where its naval power will be supplemented by planes and missiles launched from the Chinese mainland as well as resupply with munitions, weapons systems, and spare parts from the mainland. In contrast, the United States maintains significant global commitments beyond East Asia, which will limit its ability to bring to bear the full power of the U.S. Navy and other services against China in conflicts around the Taiwan Strait or South or



East China Seas.³³ The United States maintains an unchallenged global advantage at sea, but its advantage is eroding near the Chinese mainland.

Even if China's fleet does not yet threaten U.S. naval supremacy across the globe, PLAN expansion will likely continue. The number of Chinese ballistic missile submarines, nuclear attack submarines, and large surface combatants may double by 2030, according to U.S. Office of Naval Intelligence assessments.³⁴ Chinese shipbuilding facilities have been expanding for years, with China's Changxing Island shipbuilding base growing to approximately 11.5 square kilometers by 2022, about 64 percent larger than China's historic Jiangnan Shipyard.³⁵ The expansion is slated to continue, with an additional 4.3 square kilometers planned for the future.³⁶ Nor is Changxing alone. China has dozens of commercial shipyards that are significantly larger than the biggest U.S. shipyards in size and throughput.³⁷ Many of these shipyards are used for both military and civilian construction, meaning that China would be able to surge its military shipbuilding capacity more readily than the United States. The result is that China can

produce far more ships than the United States, which will allow it to increasingly challenge U.S. dominance, threaten U.S. interests outside of Asia, and potentially prevail in a war of attrition at sea.

Similar trends hold for comparisons of the U.S. and Chinese submarine fleet. The PLAN operates about the same number of submarines as the U.S. Navy, but they are much less powerful and of lower quality. China operates only 12 nuclear submarines (about a quarter of its subsurface fleet), while the United States exclusively operates nuclear submarines. Chinese submarines are growing more numerous and capable, but the United States plans to increase its submarine production in the coming decade and will probably still maintain its advantage if current expectations hold.

How long it will maintain this advantage remains unclear. China's submarine industrial base is expanding rapidly. The U.S. Department of Defense estimates a high rate of Chinese submarine production, projecting that the PLAN "submarine force will grow to 65 units by 2025 and 80 units [from 59] by 2035 despite the ongoing retirement of older hulls."³⁸ This translates to a rate of completion much faster than one new submarine every eight months, although how much faster is unclear. The U.S. Navy currently plans to buy 15



to 17 new submarines over the next 15 years, which means that the United States will produce fewer submarines but greater aggregate tonnage and combat power.³⁹

The United States' production advantage is likely eroding. The anticipated rate of U.S. nuclear submarine production only exceeds Chinese nuclear submarine production over the previous 15 years by three to five units.⁴⁰ Because China has almost certainly improved its ability to produce nuclear submarines since 2010, it can probably match or surpass the United States' rate of production over the next 15 years if it continues to produce submarines at current levels of quality, although improvements in its submarine quality might slow production. This rate of production suggests that U.S. dominance under the sea is not assured in the longer term, although the U.S. subsurface fleet will remain a key strategic advantage in the coming decade despite the PLAN's expansion.

Overall, China's economic and defense industrial growth has spurred major expansion and improvement of the PLAN. The CCP's navy remains beset by major issues, some of which are outlined in a later section of this chapter. But China has transformed in the past few decades into the world's most productive naval industrial base. Given the role that naval forces would play in any war between the United States

and China, China's ability to produce warships suggests that a prolonged war at sea between China and the United States or a U.S. partner would play to a key Chinese strength, although that is far from a guarantee of victory.

Air

China has spent the last few decades dramatically increasing the rate and quality of its military aircraft production. The United States continues to operate the world's largest and most advanced fleet of fighter aircraft, but its long-term ability to dominate the air is more uncertain than at any time since the end of the Cold War. China has been rapidly modernizing its air forces, and its ability to produce military aircraft continues to increase as the country reduces its dependence on foreign engines.

China operates the third-largest fleet of military aircraft in the world, after only the United States and Russia. The number of Chinese combat aircraft has not grown dramatically over the past 20 years, but China's air fleet has grown significantly more capable. The air forces operated by the People's Liberation

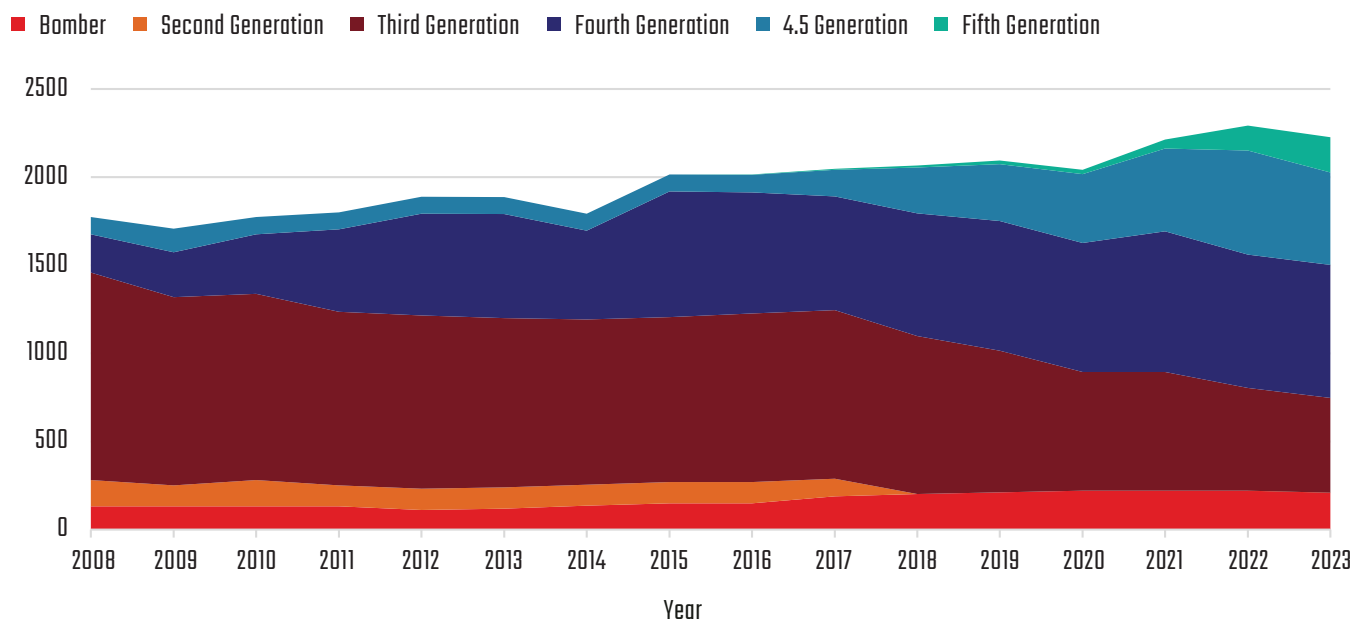


Army Air Force (PLAAF) and PLAN consist of approximately 2,250 combat aircraft, up slightly from 2,120 a decade ago.⁴¹ As shown in Figure 2.4, those planes are increasingly modern. The PLA had approximately 800 fourth- and fifth-generation combat aircraft at the end of 2016.⁴² It had almost 1,500 at the end of 2023.⁴³ China has also produced at least 200 fifth-generation

Figure 2.4 Fixed-Wing, Crewed Combat Aircraft Operated by the PLA

Note Retrofitted aircraft are classified as their original generation type due to lack of reliable data on when retrofitting occurred.

Source Data sourced from the 2009–2024 editions of the International Institute for Strategic Studies' *The Military Balance*.



J-20 fighters since the airframe's debut in 2010, with rates of J-20 completion set to increase in the coming years.⁴⁴ These numbers still trail those of the United States, which operates more than 3,300 fourth- and fifth-generation aircraft, but they represent an impressive rate of military aircraft production. The United States still retains a major advantage in the number of fifth-generation aircraft, with active-duty units operating 165 F-22 and 606 F-35 aircraft.⁴⁵

Rapid Chinese modernization will likely continue, and China is closing the production gap with the United States. Recent estimates of J-20 production suggest that China is producing more than 100 fifth-generation J-20 airframes per year.⁴⁶ Although this is lower than the expected annual F-35 production of 156 airframes per year starting in 2023, the production rate is much closer than has previously been the case and actual J-20 production numbers remain secret.⁴⁷ China has also nearly tripled the number of its more advanced J-10C, J-16, and J-20 aircraft in use over the past decade, suggesting a high rate of production.⁴⁸ A major factor in China's improving domestic manufacturing capability is the Chinese-made WS-10 and WS-20 engines, which are replacing imported Russian engines in Chinese aircraft.⁴⁹ However, China does not dominate global aircraft production the way it does shipbuilding. The United States and Europe maintain a global duopoly on large passenger aircraft.⁵⁰ In contrast, China's first domestic airliner took its initial commercial flight in June 2023 and is dependent on U.S. and European suppliers for parts.⁵¹

There are also indications that China is seeking to take advantage of its legacy fleet in new ways. China has been steadily retiring its fleet of second- and third-generation J-6, J-7, and J-8 fighter aircraft, retooling some into UASs, which would boost the size of the Chinese air fleet at low cost.⁵² This could allow China to absorb much greater attrition of aircraft in a Taiwan contingency than its industrial base or pilot training systems could otherwise support. However, these UASs remain unproven, and it would be premature to include them in assessments of Chinese airpower. What they demonstrate instead is an apparent commitment to experimentation and an effort to multiply the advantages conferred by China's rapid military modernization.

Missiles

Chinese missile capabilities are a key element of its “assassin's mace” (杀手锏) approach to combat.⁵³ The ability to use a multimillion-dollar missile to neutralize a \$13 billion aircraft carrier represents an advantage in a prolonged industrial conflict. Some mathematical modeling and wargames indicate that the ability to fire large numbers of missiles is an important determinant of attrition in a conflict between the United States and China.⁵⁴ This makes the expansion of China's missile industry an important advantage in such a conflict. The Chinese arsenal is formidable, and it consists of a rapidly growing ballistic missile stockpile and a variety of cruise missiles for which production rates are difficult to determine. China has the most active and diverse ballistic missile program in the world.⁵⁵ China also fielded its first missile with a hypersonic glide vehicle in 2022.⁵⁶

China's missile industry has been producing at a high rate. For at least the last four years, China has launched more ballistic missiles for testing and training than the rest of the world combined.⁵⁷ While the number of China's ballistic missiles is difficult to quantify, the U.S. Department of Defense assesses roughly a 200 percent increase in the number of Chinese intercontinental ballistic missiles (ICBMs) between 2016 and 2022.⁵⁸ Differences in methodology make the exact figure highly uncertain, but the growth of China's missile forces is unquestionable. China's growing number of launchers suggests a high rate of production, as highlighted in Figure 2.5. In the last five years alone, China's active ballistic missile launchers increased by about 15 percent, with the number of active ICBM launchers doubling and the number of intermediate-range ballistic missile (IRBM) launchers increasing almost fivefold.⁵⁹ This increase follows years of improvements in the Chinese ballistic missile industry.

The composition of China's missile forces has also been changing as the Chinese missile industry produces more advanced missiles. The decrease in missile launchers recorded between 2021 and 2022 is the result of the People's

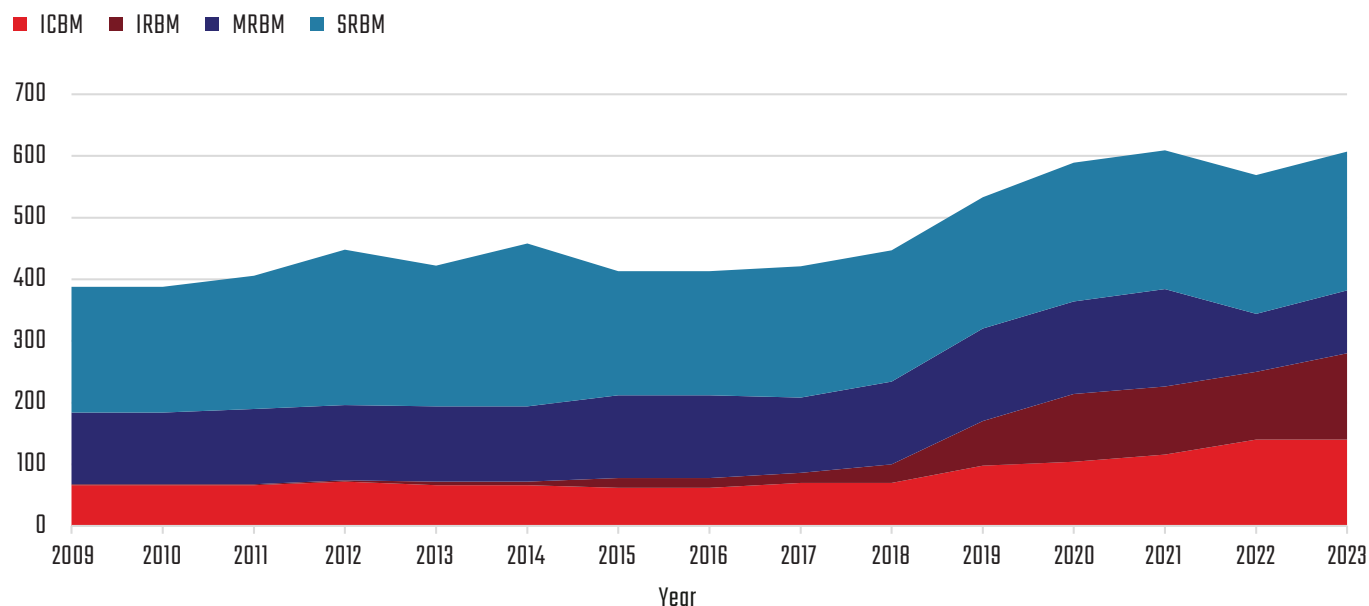


Figure 2.5 Ballistic Missile Launchers Operated by the PLARF

Source Data sourced from the 2010–2024 editions of the International Institute for Strategic Studies' *The Military Balance*.



Liberation Army Rocket Force (PLARF) losing several DF-16 and DF-21 missile brigades and gaining two DF-31AG brigades and one DF-17 brigade.⁶⁰ The DF-16 and DF-21 are short-range (SRBM) and medium-range ballistic missiles (MRBM), respectively.⁶¹ While the DF-16 has been employed only since the mid-2010s, the DF-21 has been in service since the 1990s.⁶² The DF-31AG is an upgraded ICBM capable of off-road movement and requiring fewer support vehicles, and the DF-17 is a MRBM that carries an advanced HGV.⁶³ This process is still ongoing, with the PLARF in the process of constructing at least two more DF-17 brigades along with one IRBM brigade and five ICBM brigades.⁶⁴

The DF-17 in particular presents a greater threat than a traditional ballistic missile because of the ability of its HGV to travel faster than Mach 5 and its greater degree of maneuverability after reentering the atmosphere.⁶⁵ One analysis estimates that China will field between 108 and 144 DF-17 launchers by 2028, at least doubling, if not quintupling, the number of active HGV

systems in just five years.⁶⁶ In contrast, the United States is still struggling to field hypersonic missiles, with none of the prototypes it planned to field in 2023 arriving on schedule.⁶⁷ U.S. delays may not stem from defense industrial inferiority but from more ambitious requirements.⁶⁸ Nonetheless, China's modernization remains a threat to U.S. freedom of action.

Chinese ballistic missile producers have been expanding their facilities and hiring more workers. This includes producers of missiles, engines, and launch vehicles, such as the Capital Aerospace Machinery Company, and research and development bodies, including the China Aerospace Science and Industry Corporation's Fourth Academy.⁶⁹ This increase comes alongside a 20-year effort to increase efficiency and reduce waste by consolidating China's missile industry.⁷⁰ As with China's shipbuilding industry, these expansions suggest increasing production capacity and quality. Whether in the context of a prolonged industrial war or long-term strategic competition, China's ability to produce large numbers of missiles, especially advanced hypersonic missiles, will represent a source of strength.

Land

The PLA ground forces have not benefited from increases in Chinese defense spending as much as the country's naval, air, and missile forces. Still, China's ground forces are more numerous and operate more main battle tanks and artillery pieces than their U.S. counterparts, and the People's Liberation

Army Army (PLAA) has been modernizing its ground equipment with domestic platforms over the past five years.

The PLAA is the world’s largest ground force.⁷¹ Over the past five years, it has not meaningfully increased in size, but it has grown heavier, adding nine armored brigades while reducing the number of light and mechanized infantry brigades.⁷² The equipping of these new units is ongoing, but open-source analysis indicates that 70 percent of the PLAA’s main battle tanks are now modern and that more than 60 percent of its heavy and medium combined arms brigades are equipped with modern vehicles.⁷³ These vehicles are Chinese products rather than imports—including newly developed tanks, self-propelled howitzers, and assault vehicles.⁷⁴ This is part of China’s strategy of moving its military from a “quantity-scale” type to a “quality-efficiency” type.⁷⁵

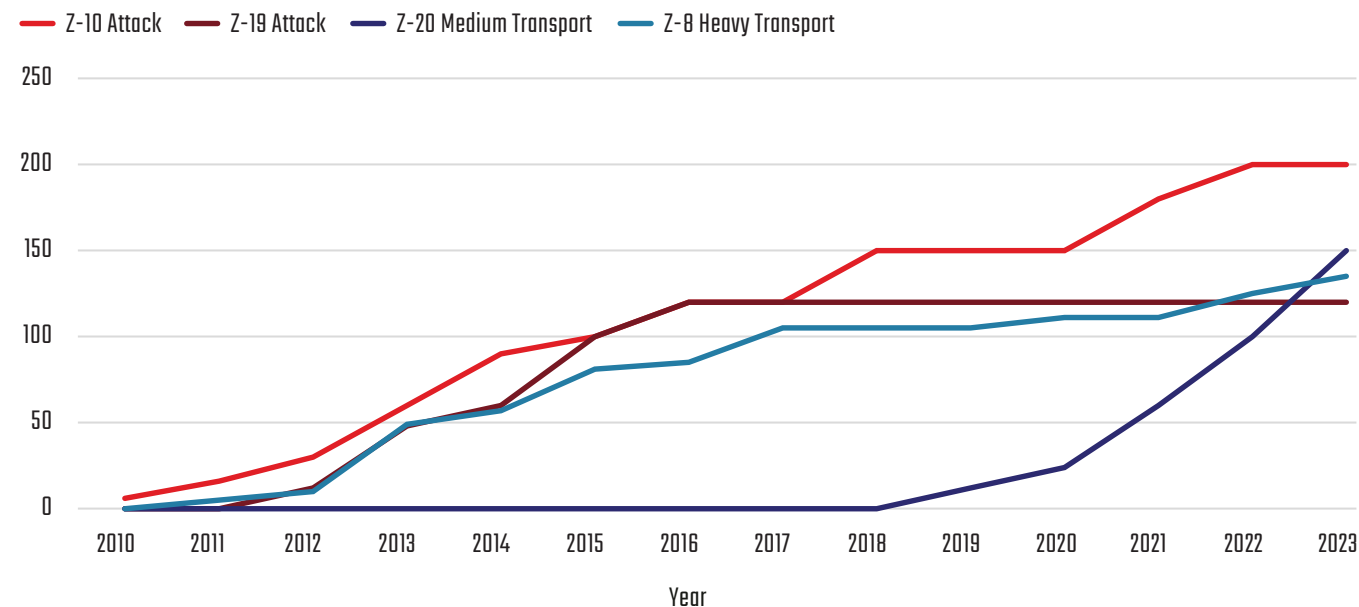
China has also developed several capabilities in the past 10 years that will probably increase the PLAA’s role in a Taiwan contingency. The first are helicopters in the PLAA’s aviation arm. China has been trying to improve the ability of its helicopter units to operate as part of a

joint campaign. China has also been steadily increasing the number of Z-10, Z-19, Z-20, and Z-8 helicopters for the past five years, as shown in Figure 2.6.⁷⁶ PLAA helicopters were observed rearming and refueling onboard PLAN vessels for the first time in 2022.⁷⁷ These capabilities could play an important role in an invasion of Taiwan.⁷⁸

A second important system is the PCH191 multiple rocket launcher, a modular system capable of firing a variety of rocket types. Long-range precision strike plays a key role in China’s military strategy in the Western Pacific. The launcher is capable of firing low-cost rockets, anti-ship cruise missiles, and land attack missiles.⁷⁹ The additional range offered by the system and its ability to strike ships will likely increase the role the PLAA can play in a Taiwan invasion, making it a key contributor to fires delivery against the island and naval forces attempting to operate in the Taiwan Strait. The apparent low price of the system’s rockets could also give the PLAA an important role to play in a prolonged conflict involving land forces.⁸⁰

Figure 2.6 Select Helicopters Operated by the PLAA

Source Data sourced from the 2011–2024 editions of the International Institute for Strategic Studies’ *The Military Balance*.



The PLAA has benefited far less from China's military-industrial development than the PLA's other combat arms, but it remains the world's largest ground force and its equipment has grown heavier and more modern over the past five years. Although the skill and technology employed by a military are major determinants of its combat power, the war in Ukraine should remind strategists that quantity still has a quality of its own. The sheer size of the PLAA remains an asset in a prolonged interstate war, especially if one of its neighbors is forced by domestic U.S. politics to fight alone.

Overall, China's defense industrial base has grown ever more capable of waging war. Given the tendency of interstate war to develop into a contest of industrial production, the rise of Chinese defense industrial capacity shifts the regional, if not yet global, balance of power toward China. But just how much it has shifted depends on more than just the number of ships, planes, and missiles China can make each year. China's industrial base and the military end users of its products have numerous weaknesses that cannot be solved by the expansion of a shipyard or an increase in jet fighter production. It is to those weaknesses that this report now turns.

Chinese Weaknesses

China's defense industry is formidable but has at least four weaknesses: an overreliance on foreign imports, uneven quality of systems, corruption, and a lack of allies and partners. Nevertheless, the size and opacity of China's defense industry make it hard for external observers to assess with complete fidelity.⁸¹ The result is that there may also be a variety of weaknesses that go unseen by both CCP and foreign analysts, weaknesses that could prove pivotal in a major war.

First, China has supply chain vulnerabilities in its defense industrial base and relies on foreign inputs, although China has reduced its reliance on some foreign parts. For example,

China's current diesel submarine fleet relies to some extent on German engines.⁸² Airplane engines are another important area of weakness, although China has prioritized developing its own high-quality aerospace engines.⁸³ China also depends on integrated circuits—computer chips with military and civilian uses.⁸⁴ While China is a major exporter of some circuits, it is also a net importer. The United States, Japan, South Korea, and Taiwan are all major net exporters, particularly for high-end chips.⁸⁵ Chinese chips remain lower quality than those produced abroad, and U.S. export control regulations enacted in late 2022 limit or effectively cut off China's access to the expertise, equipment, and export markets required to rapidly advance its chip industry.⁸⁶

A comparable weakness exists in China's dependence on imported manufacturing equipment. Chinese machine tools perform worse than foreign tools on several metrics, contributing to low rates of domestic machine tools used in high-tech industries such as aerospace.⁸⁷ The result is that high-end manufacturing still depends on imported manufacturing equipment, most of which comes from U.S. partners Germany, Japan, South Korea, and Taiwan.⁸⁸ The result of this dependence on foreign parts and manufacturing equipment is that the United States will have opportunities to weaken Chinese military production by cutting off imports through diplomatic or military measures if the two countries go to war.

The extent to which China can continue to decrease its reliance on foreign parts and tools will be a key determinant of China's actual military capacity, but the CCP is determined to do so. China is seeking to decrease its dependence on foreign parts and equipment. It has steadily reduced its arms imports in recent decades, as shown in Figure 2.7. Especially notable are the decreases in aircraft imports after major investments in weapons development programs in the mid-2000s.⁸⁹ Equally notable is the rise in engine imports as China has expanded its air forces without the ability to produce high-quality domestic aerospace engines, especially after 2017. That trend also may be coming to an end due to breakthroughs in development of aircraft engines using novel techniques and the direct acquisition of foreign firms such as Germany's Thielert Aircraft, Continental Aerospace Technologies, Superior Air Parts, and Diamond Aircraft.⁹⁰ The development of indigenous replacements will be a long and

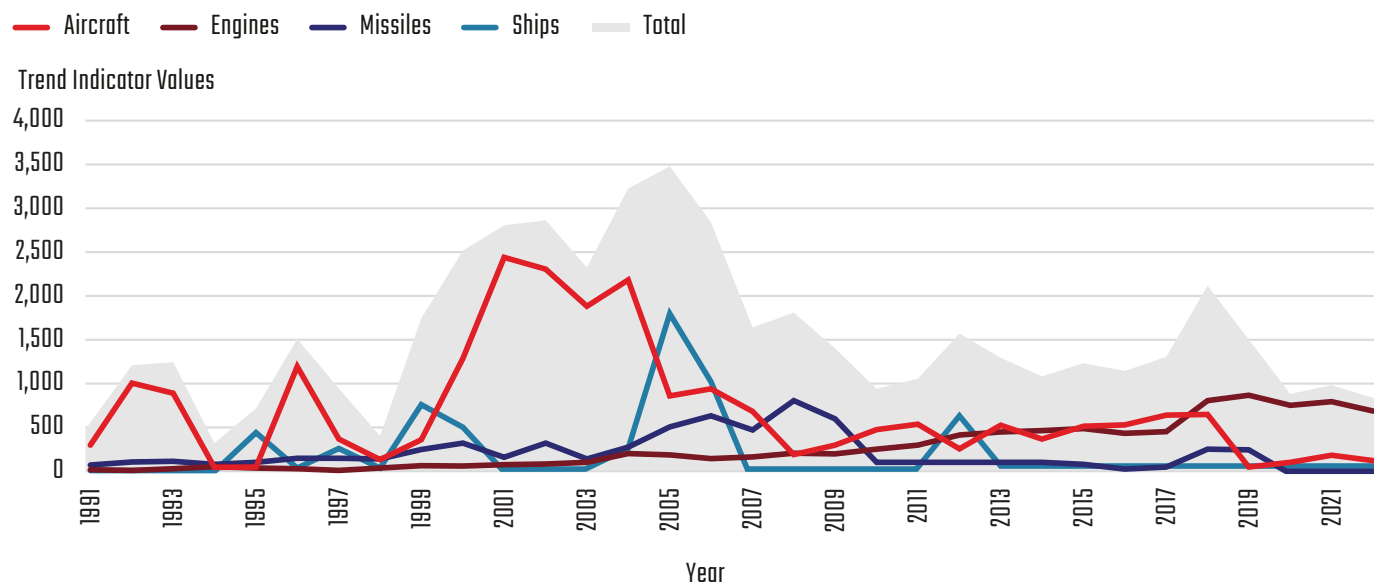


Figure 2.7 Chinese Defense Imports (Select Categories Displayed)

Source "SIPRI Military Expenditure Database," Stockholm International Peace Research Institute, 2023, <https://doi.org/10.55183/CQ6C9685>.



uneven process, however. Until it grows less dependent on imports or improves its relationship with major European and Asian producers, China's ability to replace destroyed systems in a major war will be limited either by military or political constraints on such imports.

Second, the quality of some Chinese systems is lower than that of their Western counterparts. For example, China struggles to design specialized sound-absorbing coatings, deal with vibration-suppression issues created by steam turbines, and decrease the sonar signature of its submarine hull designs.⁹¹ Chinese submarines will therefore be easier to find and destroy than U.S. submarines, rendering them relatively ineffective in a conflict with the United States. Depending on how widespread the problems with Chinese systems are, China's military could be far less impressive in reality than it is on paper. If China's systems are far less survivable or lethal than U.S. equivalents, then its productive advantages could be negated or their effects significantly reduced.

Third, corruption within the CCP, PLA, and Chinese defense industrial base is likely another weakness. Corruption has a negative impact on military effectiveness, as the Russian military discovered to its detriment during its

invasion of Ukraine.⁹² The extent of corruption throughout the Chinese defense sector is unclear. A spate of corruption investigations within the defense sector took place in 2022 and 2023, most notably in connection with the China Integrated Circuit Industry Investment Fund, but the opacity of the CCP makes it difficult to determine whether the investigations are truly driven by rooting out corruption or by ulterior domestic political motives.⁹³ Corruption within the PLA itself has historically been more widespread, with reports of corruption surrounding promotions being common.⁹⁴

Fourth, China's lack of major allies and partners is detrimental to its defense industrial base. China will likely benefit much less from its network than will the United States. South Korea and Japan have the second- and third-largest shipbuilding industries in the world, and both have among the largest navies in the world by total tonnage. The Australia–United Kingdom–United States (AUKUS) security partnership is already deepening defense cooperation between the participant countries in nuclear-powered submarines, and it could expand to other areas under AUKUS Pillar Two as well. NATO is increasingly focused on China, naming it as a "challenge" in its 2022 Strategic Concept.⁹⁵ While China has some partners, they lack the industrial and financial

power of the U.S. alliance network. Russia will be a net drain on China's industrial capacity as long as it remains bogged down in Ukraine. North Korea and Iran's economies have been crippled by sanctions, and their arms industries are focused on lower-end systems that are unlikely to help China prevail in a high-end conventional fight in the Indo-Pacific.

Operational Uncertainties

The PLA likely has a variety of operational weaknesses in translating defense capabilities to effectiveness, though China is attempting to address them. Overall, the PLA suffers from what it calls “peace disease” (和平病), its lack of combat experience since the 1979 Sino-Vietnamese War.⁹⁶ Its soldiers, equipment, and doctrine are not battle-tested, and both the PLA and external observers have identified several areas in which PLA performance may fall short.

The first problem China faces is its ability to achieve “jointness”—tight coordination of the actions of multiple services across multiple domains to maximize combat power. Structural obstacles within China's command and control systems make joint operations problematic. The PLA has created theater commands for ground, naval, and air forces, leaving the Central Military Commission responsible for command of the PLARF and People's Liberation Army Strategic Support Force (PLASSF).⁹⁷ The result is that China's ground, air, and maritime forces would be part of a joint command, while its space, cyber, and electronic warfare capabilities would be part of separate command systems. Cultural issues also abound. Chinese analysts point to interservice rivalry as a major impediment to cooperation between the PLA services.⁹⁸ CCP and PLA leadership have sought to reduce these obstacles, but it is unclear how successful these reforms have been in practice.⁹⁹

A second challenge is in the individual levels of competence exhibited by China's military personnel. Chinese media identify the “Five Incapables,” a set of shortfalls in command

The PLA suffers from what it calls “peace disease” (和平病), its lack of combat experience since the 1979 Sino-Vietnamese War.

competence. PLA assessments state that some commanders cannot “(1) judge situations, (2) understand higher authorities' intentions, (3) make operational decisions, (4) deploy forces, and (5) manage unexpected situations.”¹⁰⁰ China has consistently attempted to improve its training over the past several years, in part to keep up with its rate of industrial production and to reduce operational weaknesses. In late 2022, for example, the PLAAF expanded its training of pilots for fourth-generation aircraft to a second of its three flight academies, which will probably make its training more efficient and increase PLAAF readiness.¹⁰¹ PLAAF training prioritizes capabilities that would be vital to war with the United States, including joint air defense, electronic warfare, combat sustainment, long-range offensive strike, and maritime strike.¹⁰² It has also sought to improve its corps of noncommissioned officers, the backbone of any modern military.¹⁰³ The success of these reforms is likely uneven.

Third is logistics. The PLA would be dependent on airlift and sealift in any conflict with the United States. According to some wargames, U.S. attrition of Chinese sealift is a crucial variable determining the outcome of hostilities in Taiwan.¹⁰⁴ Logistics is likely a major weakness in the PLAA, and a lesser one in the PLAAF and PLAN.¹⁰⁵ In a Taiwan scenario, a further difficulty could be created by the lack of sufficient ground transportation within Taiwan due to a lack of heavy equipment transporters.¹⁰⁶ Another constraint on PLA logistics would likely be the airfield network, which would reduce both combat sorties and available airlift in a Taiwan scenario.¹⁰⁷ The PLA can also expect the United States or its allies to target at least some components in its logistics network, particularly sealift.

A fourth challenge is anti-submarine warfare. China is attempting to improve its anti-submarine warfare

capabilities, but it is still likely years away from being able to consistently find and destroy submarines in deep water.¹⁰⁸ The highly variable acoustic properties of the ocean environment make it difficult to detect, identify, track, and engage enemy submarines. Anti-submarine warfare requires national and joint intelligence collection platforms because of the complexities of the operating environment, the size of the maritime area that needs to be covered, and the overall mission to find, fix, track, target, and potentially engage enemy submarines. Some assessments suggest that the PLAN has underinvested in anti-submarine warfare capabilities, which have largely been neglected during modernization. Numerous PLAN ships lack organic sensors, such as towed-array and variable-depth sonar systems, and the PLA as a whole lacks sufficient helicopter and fixed-wing aircraft comparable to the U.S. Navy's P-8.¹⁰⁹

China likely faces other operational challenges. For example, Chinese military thinkers may have underestimated the need for a prolonged ground campaign in Taiwan, focusing on a few examples of urban warfare in which the attackers were unusually successful.¹¹⁰ As Russia discovered in Ukraine, the lightning successes of the First Gulf War are difficult to replicate. In addition, Taiwan's defenders could engage in a long and costly insurgency against PLA forces. There are other questions about Chinese capabilities in the maritime, air, and other domains—including in such areas as surface warfare, mine warfare, amphibious operations, close air support, and airborne intelligence, surveillance, and reconnaissance.

Conclusion

As this chapter has argued, China's defense industrial base is increasingly operating on a wartime footing and is rapidly building capabilities to deter and, if necessary, fight the United States. China is also improving its research, acquisition, and production processes and capabilities in its defense industrial base, though it has some weaknesses and operational challenges. "It's really impressive," said Under Secretary of Defense for Acquisition and Sustainment William LaPlante in discussing China's defense industrial base. "They've developed . . . really good high-end capability in numbers. So, they've done the development, and the development has been pretty continuous and not just one thing. They place multiple

bets. We don't do that. We . . . very rarely will place multiple bets and . . . [have] three different development activities going on. We used to do that. We don't do that."¹¹¹

China is operating with a sense of urgency to catch up—and potentially surpass—the United States. As the next chapter argues, however, the U.S. government is not operating with the same sense of urgency.



CHAPTER 03

CHALLENGES WITH THE U.S. DEFENSE INDUSTRIAL BASE



This chapter examines challenges with the U.S. defense industrial base. Numerous U.S. policymakers recognize the importance of the defense industrial base for deterrence and warfighting in an increasingly contested international landscape. As the Biden administration's National Defense Strategy notes, "We will prioritize joint efforts with the full range of domestic and international partners in the defense ecosystem to fortify the defense industrial base, our logistical systems, and relevant global supply chains against subversion, compromise, and theft."¹ In addition, the U.S. Department of Defense's National Defense Industrial Strategy outlines a way forward to "bolster and expand America's ability to innovate and produce the warfighting capabilities at a speed and scale that will help guarantee the ability to fight and win in any conflict."² The United States, including the Department of Defense, has made progress in some areas of the industrial base. For example, the United States has ramped up production lines for some weapons systems, such as 155-millimeter rounds, Stinger air defense systems, Javelin anti-tank weapons systems, and Patriot Advanced Capability-3 (PAC-3) air defense systems.³

Nevertheless, these steps are inadequate. The U.S. defense industrial base and broader defense ecosystem still lack the capacity to meet the U.S. military's production needs for a competitive security environment. The United States lacks the ability to respond at speed and scale—and with sufficient flexibility—to meet the needs for deterrence and warfighting. A more robust and resilient industrial

The United States lacks the ability to respond at speed and scale—and with sufficient flexibility—to meet the needs for deterrence and warfighting.



base is just as critical to deter adversary actions as it is for warfighting.

China's defense industrial base is increasingly on a wartime footing, which means that Beijing is producing weapons systems and preparing, if necessary, to fight and win a war against the United States. Russia is putting significant resources into revitalizing its defense industrial base with help from China, Iran, North Korea, and other countries. Iran remains active in the Middle East, presents a significant irregular and gray zone threat to the United States and its allies, and has increased its capacity to develop and produce medium- and long-range missiles, unmanned aircraft systems (UASs), and loitering munitions.⁴ And North Korea continues to expand its arsenal of nuclear and conventional capabilities. There is also growing defense cooperation between these countries.⁵

In addition, U.S. defense spending is historically low as a percentage of GDP, which has hamstrung Department of

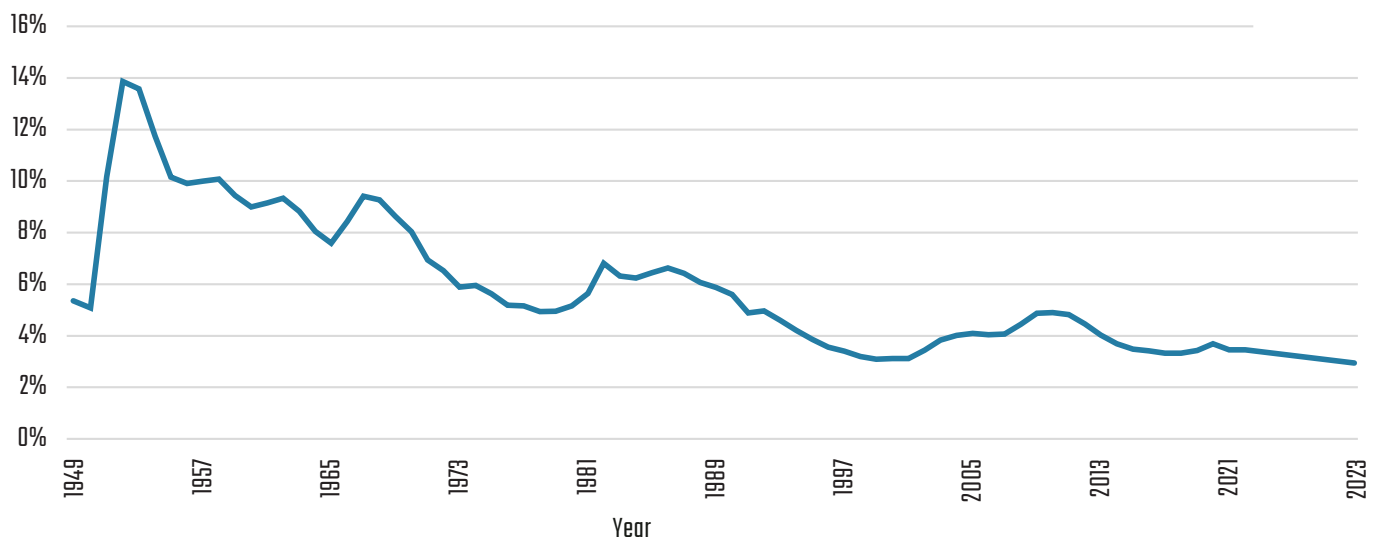
Defense efforts to revitalize the industrial base. Defense spending is also historically low as a percentage of total federal outlays.⁶ The United States currently spends around 3.5 percent of GDP on defense. As Nobel Prize-winning economist Thomas Schelling argued, effective deterrence is a function of both the intentions *and* capabilities of the deterrer.⁷ Countries need to show that they possess the military power and credible willingness to use force. As Figure 3.1 highlights, the U.S. defense budget peaked at 14 percent of GDP during the Korean War. It was between 9 and 11 percent during President Eisenhower's "New Look" policies in the 1950s, between 8 and 9 percent during President John F. Kennedy and President Lyndon Johnson's "Flexible Response" period in the 1960s, and over 6 percent during President Ronald Reagan's defense buildup in the 1980s.⁸

After the collapse of the Soviet Union and the end of the Cold War, defense budgets dramatically decreased to 3 to 4 percent in the absence of a major conventional threat.⁹ In addition, Secretary



Figure 3.1 U.S. Defense Spending as a Percentage of GDP, 1951–2023

Source "SIPRI Military Expenditure Database," Stockholm International Peace Research Institute, 2023, <https://doi.org/10.55163/CQGC9685>.



of Defense Les Aspin and Deputy of Secretary of Defense William Perry convened a remarkable dinner of defense industry executives in 1993 at the Pentagon, which infamously became known as the “Last Supper.”¹⁰ Perry told the group that the administration was cutting the defense budget and that they needed to consolidate. In response, the number of defense companies plummeted from 107 large and small companies in 1990 to 5 major primes by the end of the decade.¹¹ Defense budgets briefly crept above 4 percent during the surges in Afghanistan and Iraq, although the funding went to wartime operations and not to revitalizing the defense industrial base. Nevertheless, defense budgets shortly fell back to the 3 percent range. The post–Cold War decline in the defense budget was understandable and appropriate.¹² But the situation has changed dramatically over the past few years. Today’s defense budget is historically small, particularly in light of such adversaries as China, Russia, Iran, and North Korea.

The rest of this chapter examines the U.S. defense industrial base in several areas: presidential-level support, defense production (including munitions stockpiles, the contracting process, supply chains, and the workforce), and allies and partners (including foreign military sales and technology transfers). These areas were chosen because they represent critical parts of the defense industrial base.¹³ There are numerous other areas, such as research, development, and the acquisitions process, that deserve attention. The chapter concludes with a brief examination of arguments against major changes in the defense industrial base.

Bureaucratic Challenges

There is little urgency today from the White House to revitalize the United States’ lagging defense ecosystem and insufficient incentives for industry. In addition, there are major coordination challenges at various levels of the defense industrial base: between various

There is little urgency from the White House to revitalize the United States’ lagging defense ecosystem and insufficient incentives for industry.

U.S. government departments and agencies, between the government and private sector, and between the U.S. government and foreign governments. Within the United States, many entities beyond the Department of Defense play important roles in the defense industrial base, including the Department of State, Department of Commerce, Department of the Treasury, Congress, the private sector, and other stakeholders. In fact, the growing role of commercial technology in modern defense systems has increased the role of non-defense agencies in the industrial base.

However, there are several challenges with the current situation.

First, there is no major body that can serve as an executive agent directly under the president with the power and authority to break bureaucratic logjams and coordinate across departments and agencies. Multiple agencies—such as the Departments of State and Commerce, as well as various organizations within the Department of Defense (including the military services)—have competing interests, priorities, and authorities. In addition, Congress, the defense industry, and other actors have their own interests, priorities, and authorities.

These challenges are not new, but they are part of the reality of bureaucratic politics in the United States. As Morton Halperin and Priscilla Clapp conclude in their influential book *Bureaucratic Politics and Foreign Policy*, the government “consists of numerous individuals” and agencies with “very different interests and priorities, and they are concerned with very different questions.”¹⁴ One example is the International Traffic in Arms Regulations (ITAR), which oversees the production, export, and import

of defense articles, defense services, and other activities.¹⁵ There are bureaucratic differences in how broadly limits on arms transfers should apply. Department of Defense officials have sometimes erred on the side of providing technology to allies and partners, while the Department of State—and some members of Congress and their staff—have been less willing to accept risk.¹⁶

Second, there has been insufficient action to fix current problems. The president plays a particularly important role in providing strategic guidance and urgency. As Halperin and Clapp argue, “The president stands at the center of the



Table 3.1 Example of White House–Led Defense Institutions
Source CSIS.

| DEFENSE INSTITUTION | PRESIDENT | YEARS | RESPONSIBILITIES |
|---|-----------------------|-----------|--|
| National Defense Advisory Commission | Franklin D. Roosevelt | 1940–1941 | Advise the U.S. president on better coordinating key parts of the U.S. defense industrial base, including production, raw materials, employment, farm products, transportation, price stabilization, and consumer protection. |
| Office of Production Management | Franklin D. Roosevelt | 1940–1942 | Coordinate the procurement and production of armaments and equipment, including the conversion of industry from civilian to defense production. |
| War Production Board | Franklin D. Roosevelt | 1942–1945 | Exercise general direction over U.S. war procurement and production; determine the policies, plans, and procedures of federal departments regarding procurement and production; establish priorities in the distribution of materials and services; and prohibit non-essential production. |
| Civilian Production Administration | Harry Truman | 1945–1947 | Oversee the transition from wartime to peacetime production, including expanding the production of materials in short supply and granting priority assistance to breaking bottlenecks that impede the reconversion process. |
| Office of Defense Mobilization | Harry Truman | 1950–1958 | Plan, coordinate, direct, and control all wartime mobilization activities of the U.S. government. |
| Office of Defense and Civil Mobilization | Dwight D. Eisenhower | 1958–1973 | Coordinate military, industrial, and civilian mobilization. It was later renamed the Office of Civil and Defense Mobilization, Office of Emergency Planning, and then Office of Emergency Preparedness. |
| Emergency Mobilization Preparedness Board | Ronald Reagan | 1981–1988 | Improve mobilization capabilities and interagency cooperation within the federal government to respond to major peacetime or war-related emergencies, including to oversee military and insutrial mobilization. |

foreign policy process in the United States. . . . In any foreign policy decision widely believed at the time to be important, the president will almost always be the principal figure determining the general direction of actions.”¹⁷ Without direct and forceful presidential action, major changes in the defense industrial base are significantly more challenging. As noted below, Presidents Roosevelt, Truman, Eisenhower, and Reagan played important roles in revitalizing the defense industrial base during their presidencies.

These problems are not new. Presidential leadership has been essential during critical periods of U.S. history to strengthen—or consolidate—the defense industrial base. But words have generally not been sufficient.

Roosevelt, Truman, Reagan, and others created institutional bodies to advise the president on better strategic guidance and coordination across the U.S. government and with the private sector, issue directives, and even directly plan, coordinate, direct, and control industrial mobilization. Table 3.1 shows several examples of institutional structures designed to jump-start the defense industrial base.

In May 1940, a year and a half before Pearl Harbor and the United States' entry into World War II, a perceptive President Roosevelt created the National Defense Advisory Committee (NDAC) to help coordinate various segments of the U.S. defense industrial base. It included seven members: William Knudsen, the president of General Motors; Edward Stettinius, Jr., president of U.S. Steel; Chester C. Davis, president of the Federal Reserve Bank of St. Louis; Leon Henderson, a member of the Securities and Exchange Commission; Sidney Hillman, president of the Amalgamated Clothing Workers of America; Ralph Budd, chairman of the board of the Chicago, Burlington, and Quincy Railroad; and Harriet Elliott, dean of women from the University of North Carolina.¹⁸ When Knudsen asked Roosevelt at the first meeting who was head of the group, Roosevelt responded that he was as president of the United States.¹⁹ Roosevelt's point was that a major revitalization of the defense industrial base required the oversight of the U.S. president. Roosevelt's strategic guidance and decision to spend money on defense was essential to mobilization well before World War II.

On January 16, 1942, Roosevelt created the War Production Board to supervise production. He appointed Donald M. Nelson, executive vice president of Sears Roebuck, as the chair. The body exercised general direction over U.S. war procurement and production; determined the policies, plans, and procedures of federal departments regarding procurement and production; directed conversion of companies from peacetime to wartime work; established priorities in the distribution of materials and

services; and prohibited nonessential production.²⁰ Since the country was at war, the War Production Board also rationed such commodities as gasoline, heating oil, metals, rubber, paper, and plastics.²¹

President Truman abolished the Office of War Mobilization after World War II, but he quickly switched gears as the Cold War began. He established a cabinet-level Office of Defense Mobilization to plan, coordinate, direct, and control all defense industrial production.²² He established a National Security Resources Board to mobilize natural resources and the scientific community to meet the United States' growing military demands.²³ Truman also signed the Defense Production Act on September 8, 1950, which authorized the president to force companies to prioritize defense production, set aside price ceilings, and expand private and public production capacity during the Korean War.²⁴ The National Security Resources Board also helped mobilize the economy for war through regulation of the private market and takeover of industrial production. Under the act, the government could control prices, build defense plants, regulate credit, and streamline resources and products for manufacturing. Congress would go on to reauthorize the Defense Production Act at least 53 times over the next seven decades.²⁵

In 1981, President Reagan created the Emergency Mobilization Preparedness Board to improve mobilization capabilities and interagency cooperation within the federal government to respond to major peacetime or war-related emergencies. The board consisted of the representatives of 22 key federal agencies at the deputy secretary or under secretary level and was chaired by the assistant to the president for national security affairs. A full-time secretariat was established to support the board and monitor the implementation of its recommendations by federal agencies.²⁶ It included senior representatives from several departments and agencies:

- » Department of Defense
- » Department of Commerce
- » Department of Agriculture
- » Department of the Treasury
- » Department of Justice
- » Federal Emergency Management Agency

- » Department of Health and Human Services
- » Department of Labor

These institutional bodies were particularly important during periods of significant strategic competition (such as at various points in the Cold War) and during wars. As President Roosevelt recognized before World War II and President Reagan decided during heightened tension, a presidential-level body can be critical *before* war—in part to strengthen deterrence and potentially avert war. President Roosevelt perhaps said it best in arguing that “we must be the great arsenal of democracy” and to “build now with all possible speed every machine, every arsenal, every factory that we need to manufacture our defense material.”²⁷ The absence of an effective institution tied to the president has made it difficult to revitalize the defense industrial base.

Defense Production

Today, the United States faces substantial challenges in defense production. The war in Ukraine has highlighted some significant production problems, even when the United States is not directly at war and has not committed soldiers, sailors, and air crews to fight in Ukraine. In response to initial production challenges, the Department of Defense and private sector eventually increased production for some weapons systems, such as 155-millimeter rounds, Stingers, Javelins, and PAC-3 systems.

Nevertheless, the U.S. defense industrial ecosystem—the executive branch, Congress, and industry—lack the speed, agility, and depth to replace weapons stockpiles and systems in a sufficient timeframe for the current security environment. As Under Secretary of Defense for Acquisition and Sustainment William LaPlante acknowledged, the U.S. defense industrial base is “dialed down to the *minimum amount*. . . . [We have] very few development programs, [a] minimal amount, and then very few production programs.”²⁸ In addition, as the United States and other countries have reduced their stockpiles of weapons systems to send to such countries as Ukraine, they often do not replenish with the exact same systems. In some cases, the infrastructure and tooling does not exist anymore to replace depleted stockpiles of legacy systems, so the U.S. government turns to the latest generation. But new generations aren’t always available, creating a gap and compounding shortfalls.²⁹

Congressional dysfunction has been unhelpful to the industrial base, including the failure to pass budgets and the reliance on continuing resolutions (CRs). As Secretary of the Army Christine Wormuth explained, “The Army cannot exercise its Multi-Year Procurement to purchase additional Patriot missiles or begin construction on a Guided Missile Maintenance Building under a CR. This will impede our ability to send a consistent demand signal to industry and will limit production and maintenance capacity on critical munitions.”³⁰ CRs can also delay acquisition efforts and the awarding of contracts for critical weapons systems and infrastructure upgrades for the industrial base.

There are several broad challenges with defense production.

Munitions Shortfalls: The U.S. military continues to have a shortfall of munitions and other weapons system for deterrence and warfighting. As Figure 3.3 highlights, examples include the Long Range Anti-Ship Missile (LRASM), PAC-3, Standard Missile-6 (SM-6), MK-48, Tomahawk land-attack missiles (TLAM), Advanced Medium-Range Air-to-Air Missile (AMRAAM), and Naval Strike Missile. Some analysis suggests that protracted regional conflicts will expend significant quantities of munitions, likely exceeding current Department of Defense planning efforts. In nearly two dozen iterations of a CSIS wargame that examined a U.S.-China war in the Taiwan Strait, the United States typically expended more than 5,000 long-range missiles in three weeks of conflict, including 4,000 Joint Air-to-Surface Standoff Missiles (JASSMs), 450 LRASMs, 400 Harpoons, and 400 TLAMs. One of the most important munitions to prevent a Chinese seizure of all of Taiwan were long-range precision missiles, including missiles launched by U.S. submarines.³¹

LRASMs offer a useful case study. In every iteration of the wargame, the United States expended its inventory of LRASMs within the

The U.S. military continues to have a shortfall of munitions and other weapons system for deterrence and warfighting.

first week of the conflict. These missiles were particularly useful because of their ability to strike Chinese naval forces from outside of the range of Chinese air defenses. As the wargame showed, Chinese defenses are likely to be formidable—especially early on—thus preventing most aircraft from moving close enough to drop short-range munitions. Bombers generally employed these munitions because they could be based outside of the range of Chinese missiles.³² In addition, it takes nearly two years to produce LRASMs, creating a time lag to fix the shortfall.³³

One challenge with munitions stockpiles is having sufficient numbers for a protracted conflict. The dilemma for the government, in particular, is to try to match the *production rate* of weapons systems with the *consumption rate* in a possible war.³⁴ This is more of an art than a science, since it requires estimating the possible timelines and munitions usage in a future war. For example, will a possible conflict between the United States and China over Taiwan be short or long? Will it spread to other theaters? What types of munitions and weapons systems will it involve? There are no clear answers to these questions, and numerous variables impact the duration and geographic expanse of wars.³⁵ But several issues need to be considered.

First, wars between major powers can be long in duration. In general, the mean war duration for interstate wars is roughly 15 months. But wars involving one or more major powers can last for longer, including the Crimean War (28 months), Russo-Japanese War (16 months),

World War I (52 months), World War II (over 60 months), Korean War (36 months), Vietnam War (121 months), and Sino-Vietnamese War (60 months).³⁶ Consequently, it would be prudent to plan for wars of longer, rather than shorter, durations.

Second, wars involving major powers can use significant quantities of munitions. In addition, weapons systems and platforms—such as main battle tanks, armored personnel carriers, artillery, and fighter aircraft—are destroyed or experience significant wear and tear from constant use. The war in Ukraine highlights that conventional wars involving one or more major powers can require a robust defense industry (or access to the defense industry of allies) to produce sufficient quantities of munitions and weapons systems.

Third, stockpiles are important not just for warfighting, but for deterrence. As highlighted by Thomas Schelling's work, deterrence is more effective if states have sufficient stockpiles (capabilities) and are prepared to use them (intentions).³⁷ "Production is deterrence," remarked Under Secretary of Defense for Acquisition and Sustainment William LaPlante.³⁸ And this is not just for typical ground, air, and maritime systems—but also for satellites. Take, for example, the production of satellites for low Earth orbit (LEO). It is beneficial to have hot production lines for satellites for several reasons, including to ensure a proliferated constellation to maximize intelligence, surveillance, and reconnaissance; replace satellites with short life spans; and increase deterrence.³⁹ If an adversary sees that a state is mass-producing LEO satellites, shooting them down has a limited impact.

Contracting Challenges: The contracting process continues to be a challenge for defense production, though there has been progress. The Department of Defense has created a Joint Production Accelerator Cell (JPAC) within the Office of the Under Secretary of Defense for Acquisition and Sustainment to improve production capacity, resiliency, and surge capacity for specific weapons systems and supplies. JPAC is the successor to the Munitions Industrial Base Deep Dive. One of JPAC's successes has been to extend multiyear procurement to some nontraditional items, as well as to use multiyear procurement with large lot procurement methods.

Yet some congressional members and staff—including from the House and Senate Appropriations Committees—

are risk averse on such issues as multiyear contracts. As discussed at the end of this chapter, some policymakers are concerned that multiyear contracts will unnecessarily commit the United States to fund weapons systems and reduce budget flexibility. Yet multiyear contracts are critical for increasing production capacity, resilience, and supply chain support. Defense companies are unwilling to take financial risks without contracts—particularly multiyear contracts—in place. It is not a sound business decision to produce more munitions or weapons systems without a clear demand signal and financial commitments, especially given the large capital investment and number of personnel required.⁴⁰

This risk aversion is compounded if companies have to make additional capital investments to increase defense production—especially investments for facilities, infrastructure, and tooling. As one Department of Defense study concluded, “Producers benefit from steady or predictable orders, so the DoD’s inconsistent procurement and concurrent production ramps (both increases and decreases) exacerbate the challenges suppliers face across the DIB [defense industrial base].”⁴¹ There has been an inconsistent demand signal from the Department of Defense to build up stockpiles, which risks production lines being shut down.⁴² Part of the challenge is the difficulty of predicting future demand. For example, what if the war in Ukraine winds down following a negotiated settlement? What if the current or future administration loses interest in supporting another “forever war?” Or what if Congress refuses to obligate funds?

While the Department of Defense signs multiyear contracts for ships and airplanes, it does not sign multiyear contracts for a range of munitions and other weapons systems. After all, the services—such as the Navy and Marine Corps—have historically cut munitions from their budgets to make room for other priorities, or to fix problems that arise during the acquisition of those systems.⁴³

More broadly, the Federal Acquisition Regulation (FAR) process is too bureaucratic, time intensive, and inefficient. It tends to stifle innovation, reward compliance rather than results, and discourages many world-class commercial companies from doing business with the U.S. government. As Jacques Gansler, former undersecretary of defense for acquisition, technology, and logistics, acknowledged over a decade ago, “Such excessive regulation also discourages government contracting personnel from applying management flexibility

as they interpret the steps that should be taken in the interests of efficiency and effectiveness.”⁴⁴

Supply Chain Issues: There continue to be supply chain challenges that hinder production. For example, there is limited production of key components, such as solid rocket motors, processor assemblies, castings, forgings, ball bearings, microelectronics, and seekers for munitions.⁴⁵ Dependence on a small number of private firms—or even a single source—leaves the United States highly vulnerable to supply disruption. In addition, the United States is overreliant on single or foreign sources for key components or materials. This dependence has been particularly acute for certain strategic and critical materials, including antimony, lithium, and some rare-earth minerals.⁴⁶ China dominates the advanced battery supply chain across the globe, such as lithium hydroxide, electrolyte, lithium carbonate, anodes, and cathodes.⁴⁷ As noted in Chapter 2, however, China’s defense industrial base also has supply chain vulnerabilities.

Sub-tier suppliers are also at risk. Many operate on narrow profit margins, which makes them susceptible to cyclical defense demands and changes in the defense budget. These challenges undermine the ability and willingness of some sub-tier suppliers to remain in the defense market. In a 2023 report, the Office of the Assistant Secretary of Defense for Sustainment concluded:

Supply chain risks are not unique to the Department, but such risks take on greater urgency when considered in light of national security. For example, to keep aging weapon systems operational, we [DOD] depend on a finite number of repair parts suppliers, some of which are precariously close to fiscal collapse. The proliferation of counterfeit items (particularly for microelectronics) increases the risk of mission delay or imperiled safety. Intellectual property vulnerabilities and lowered integrity of sensitive data and secure networks undermine the protections around our weapon system designs. Dependence on foreign entities for critical items and cyber disruptions to the manufacturing and

Today's workforce is inadequate to meet the challenges of the defense industrial base.

transportation domains likewise jeopardize mission support and success.⁴⁸

Workforce Constraints: Today's workforce is inadequate to meet the challenges of the defense industrial base. The U.S. labor market is unable to provide a sufficient number of workers with the right skills to meet the defense demands of today and tomorrow. Retention is also a significant challenge.⁴⁹ Skills in short supply range from software engineers to welders. As Under Secretary of Defense LaPlante argued, "the workforce in many ways is the most stressing element right now, both talented workforce, in terms of writing software, engineering, but also the workforce that does the production and is conversant in advanced production, whether it's additive or subtractive manufacturing."⁵⁰

Shipyards are particularly problematic. Some skills sets, such as nuclear welding, are particularly difficult to acquire outside of U.S. Navy procurement. But the workforce shortage is widespread. In 2024, the Navy briefed Congress that the first Constellation-class guided-missile frigate (FFG-62) will be at least a year late because of workforce shortfalls at Fincantieri's Marinette Marine shipyard. The Wisconsin shipyard is short of several hundred blue- and white-collar workers, including welders.⁵¹ In 2022, the Navy ended the fiscal year short 1,200 workers across its four shipyards. As the head of Naval Sea Systems Command remarked, hiring and retaining skilled workers in government repair yards and private sector shipbuilding is the Navy's

top strategic challenge across the enterprise.⁵² In addition, construction of the Block V version of the Virginia-class fast-attack submarine is at least two years behind schedule because of workforce constraints and other factors.⁵³

Allies and Partners

The Biden administration's National Security Strategy and National Defense Strategy rightly emphasize the importance of allies and partners in today's competitive landscape. In the defense industrial base, working with allies and partners involves several examples: co-development, co-production, co-sustainment, second-sourcing, and licensed production. Some foreign companies—particularly from allied and partner countries—have U.S.-based subsidiaries, such as Leonardo DRS, BAE Systems, and Austal, which manufacture products or conduct services for unclassified and classified Department of Defense programs.⁵⁴

Yet the United States does a poor job of sharing technology and selling weapons systems to its most important friends—the countries with which it needs to cooperate for both deterrence and warfighting. It is virtually inconceivable that the United States would fight a major war on its own. U.S. export controls and technology security and foreign disclosure processes *undermine* the ability to collaborate with allies and partners. This reality is especially disconcerting because the United States shares some of its most sensitive secrets with allies and partners—including the United Kingdom, Australia, Canada, and New Zealand, which make up the "Five Eyes" intelligence community.⁵⁵

This section focuses on two areas where the United States faces serious challenges: foreign military sales and technology transfer policies and procedures.

Foreign Military Sales: The Foreign Military Sales (FMS) program is a form of security assistance in which the United States sells defense articles and services to foreign countries.⁵⁶ The Department of State's Office of Regional Security and Arms Transfers, located in the Bureau of Political-Military Affairs, oversees FMS transactions. The Defense Security Cooperation Agency (DSCA) implements specific FMS cases. The Department of State's Directorate of Defense Trade Controls (DDTC), which also sits within the Bureau of Political-Military Affairs, issues and administers licenses for commercial sales.⁵⁷ Congress ultimately reviews foreign military sales

that rise to the threshold for congressional notification.⁵⁸ Several parts of the Department of State are involved, including the Bureau of Political Military-Affairs, the Office of Regional Security and Arms Transfers, the Office of Security Assistance, and the DDTC. Several parts of the Department of Defense are involved in FMS, including the DSCA, the military services, the Joint Staff, and various offices within the Office of the Secretary of Defense.⁵⁹

When an eligible foreign government opts to purchase or otherwise acquire a U.S. defense system or service, it initiates the formal process by issuing a letter of request (LOR). The government submits the LOR to a U.S. security organization or the DSCA. Following approval of the transfer, the United States responds with a letter of offer and acceptance (LOA). The time it takes to prepare an LOA can vary based on such factors as the foreign government involved, the weapons system or service requested, and the overall complexity of the sale. It can be fast for routine items, but long and difficult for others. Then there is the production of the system, including non-recurring items such as software updates and modifications.⁶⁰

There has been some progress in improving the FMS process. For example, the Department of Defense completed an FMS Tiger Team with several dozen concrete actions to streamline FMS.⁶¹ In addition, Department of State officials report that they approve 95 percent of FMS cases within 48 hours for their portion of FMS.⁶²

Nevertheless, the entire FMS process—from initial discussions to LOR, LOA, production, and modifications—is too long. It takes an average of 18 months to get FMS cases on contract.⁶³ There is also no real accountability in the FMS system. The Department of State statutorily owns it, but execution largely falls to the Department of Defense and is split among the military services and several Department of Defense agencies. No one is held accountable for strategic success or failure. Partner and ally requests for U.S. systems can go unanswered for months or even years. FMS programs are executed under a U.S. government contract negotiated and awarded by a U.S. military service contracting officer on behalf of the FMS partner. The Department of Defense contracting community is understaffed. FMS contracts are sometimes given a low priority by contracting officers, who look first to support U.S. service personnel, then to contracts to support innovation for next-generation capabilities for

U.S. service personnel, then to FMS. In addition, staffing constraints, technological limitations, and the increasing complexity of systems could slow the rate at which transactions are approved if there is a major increase in FMS.⁶⁴

Technology Transfer Policies and Procedures: A related issue includes technology transfer review policies and procedures—including ITAR—for FMS and Direct Commercial Sales (DCS).⁶⁵ ITAR is the U.S. regulation that controls the manufacture, sale, and distribution of defense and space-related articles and services.⁶⁶ ITAR and other regulations are important and are designed to prevent the transfer of sensitive technology to adversaries and, in some instances, to signal disapproval to foreign countries because of their actions.⁶⁷

The United States has a long-standing exemption for Canada and can transfer some unclassified defense material and services without an export license. This exemption is limited, and companies sometimes avoid using the exemption because they are worried about the consequences of ITAR violations. Exports to Canada of classified and more sensitive material and services still require a license.⁶⁸ In addition, there have been several historical cases in which the United States has made exceptions to technology transfers when there are strategic imperatives, such as countering the Soviet Union's growing capabilities during the Cold War or aiding Ukraine following Russia's 2022 invasion. For example, the United States and United Kingdom signed the Polaris Sales Agreement in 1963, which allowed the United States to export Polaris missiles, launch tubes, fire control systems, and relevant technologies to the United Kingdom to build and maintain its submarine-based nuclear weapons systems.⁶⁹ U.S. and other NATO officials had become increasingly concerned about the Soviet Union's nuclear and conventional capabilities and their impact on the military balance in Europe.⁷⁰

There were several failed efforts to gain ITAR exemptions for the United Kingdom and Australia in the early 2000s. In 2010, the United

States tried again and signed treaties, ratified by the Senate, that created a “trusted community” of companies in the United States, Australia, and United Kingdom that could share technology and compete for opportunities.⁷¹ But these treaties and other arrangements failed to significantly increase technology cooperation and have almost never been used by industry.⁷²

The reality today is that the United States has failed to make significant progress in reducing export barriers, particularly with its closest allies and partners. These obstacles undermine co-development, co-production, co-sustainment, and other types of cooperative arrangements that provide benefits by increasing economies of scale, supporting the U.S. defense industrial base (including providing jobs to U.S. workers), and strengthening allies and partners. Incorporating allies and partners into the development, execution, and sustainment of programs is not always a top-level priority for some U.S. defense acquisitions specialists, even with a push by senior Department of Defense officials for greater technology sharing with allies and partners. In the development of acquisition programs, requirements documents are too frequently overclassified and marked “SECRET//NOFORN,” which prohibits sharing with foreign governments.⁷³

Even for close allies, there are notable delays, confusion, and unpredictability with the U.S. technology transfer process—a sign of a peacetime, not a wartime, process. The U.S. Technology Security and Foreign Disclosure (TSFD) process often causes delays for close allies, which prevent them from doing technical assessments before they even get to the LOR stage. The TSFD process is also far too opaque and unpredictable. These challenges can significantly impact time-sensitive actions, such as refitting ships during fixed docking periods.⁷⁴

With the United Kingdom, for example, U.S. delays held up a routine upgrade on sonar systems for UK Royal Navy submarines for several months, while another UK submarine had to wait months to be serviced by a cleared contractor until the U.S. Department of State

The reality today is that the United States has failed to make significant progress in reducing export barriers, particularly with its closest allies and partners.

authorized an export-controlled component. As one analysis concluded, “months went by waiting for a license that just added cost and risk to an ally’s military capability.”⁷⁵ More broadly, the United Kingdom spends a shocking \$500 million each year—almost 1 percent of its defense budget—complying with ITAR regulations.⁷⁶ As another assessment concluded: “When close U.S. allies—or their defense firms—wish to develop technology or acquire capability from the United States, they have to navigate a byzantine system of regulation. This costs time and money, undermines allies’ sovereignty, stifles innovation, and blunts the United States’ edge in the strategic competition with China.”⁷⁷

The United States is far too risk averse and needs to rethink the benefits of sharing technology with its closest allies and partners, as well as the risk of *not sharing* that information. As Under Secretary of Defense LaPlante argued, “the system is built around a risk of technology exploitation by an adversary. High risk of that. We want to make sure we mitigate against that. Well, you have that risk but now we also have the operational imperative of what we’re facing in the Indo-Pacific, and we have to just get over it with close allies and partners like the UK and Australia.”⁷⁸

Similarly, the chief of the United Kingdom’s navy, Admiral Sir Ben Key, remarked that “what we want to be able to do is move quicker” in today’s competitive security environment in the area of technology transfers. The risks of an overly regulated and risk-averse defense culture is highlighted in Andrew Gordon’s book, *The Rules of the Game: Jutland and British Naval Command*, which examined British failures between the Battle of Trafalgar and the Battle of Jutland. In

periods of peace, regulators often predominate. But in periods of war, in which countries must move quickly against cunning adversaries, “rat catchers” need to dominate. As Admiral Key asked, “Are we setting up the ITAR and all the rest of it to allow the regulators or the rat catchers? And what is it we’re trying to achieve?” He continued that “what we really want to do is in a contested environment, when the pressure is really on, we want the information to move between allies and partners and friends as fast as we possibly can with as few hurdles as we can.”⁷⁹

There was some hope that AUKUS—the security pact initiated in 2022 between Australia, the United Kingdom, and the United States to cooperate on sensitive technologies, including nuclear-powered submarines—might usher in a new era of technology cooperation between the three countries. But that has not been the case—at least not yet. As outlined in Table 3.2, the second pillar of AUKUS raises the prospect of expanding the research, development, and fielding of advanced capabilities in six technological areas (undersea capabilities, quantum technologies, artificial intelligence and autonomy, advanced cyber, hypersonic and counter-hypersonic capabilities, and electronic warfare)

and two broad functional areas (innovation and information sharing).

Another example of a challenge in technology sharing is the National Technology and Industrial Base (NTIB). It was first codified in U.S. law in 1992 when the United States and Canada were designated as *one* national technology industrial base. The 2017 National Defense Authorization Act (NDAA) added the United Kingdom and Australia—and the 2023 NDAA added New Zealand.⁸⁰ The NTIB consists of the people and organizations engaged in national security and dual-use research and development,

Table 3.2 AUKUS Pillar Two Technologies and Functional Areas
Sources “AUKUS Fact Sheet,” The White House, April 5, 2022, <https://www.whitehouse.gov/briefing-room/statements-releases/2022/04/05/fact-sheet-implementation-of-the-australia-united-kingdom-united-states-partnership-aokus/>; and Patrick Parrish and Luke A. Nicastro, *AUKUS Pillar 2: Background and Issues for Congress*, CRS Report NO. R47599 (Washington, DC: Congressional Research Service, June 2023), <https://crsreports.congress.gov/product/pdf/R/R47599>.

| ADVANCED CAPABILITIES | EXPLANATION |
|--|--|
| Undersea Capabilities | Autonomous systems that operate underwater, which could be used for intelligence, surveillance, and reconnaissance; anti-submarine warfare; anti-surface warfare; minesweeping; and other missions. |
| Quantum Technologies | Technologies that use the principles of quantum physics, such as superposition and quantum bits, to create or improve military capabilities. This technology can be used to enhance communications systems, information processing, and sensor capabilities. |
| Artificial Intelligence (AI) and Autonomy | Technologies that can perform tasks without significant human oversight. In the military realm, there are numerous possible uses, including air defense systems, image recognition, text analysis, rapid decisionmaking, combat simulation, data processing, and swarming. |
| Advanced Cyber Capabilities | Technologies and practices that focus on protecting critical infrastructure and operational systems from cyberattack, expanding cyber cooperation, and encouraging other activities. |
| Hypersonic and Counter-hypersonic Capabilities | Maneuverable weapons that fly at speeds of Mach 5 or greater, as well as systems that counter such weapons. |
| Electronic Warfare | Tools, techniques, and technology that manipulate and control the electromagnetic spectrum for military purposes. Examples might include electronic protection, electronic attack, and electronic support. |
| Innovation | A change in the conduct of warfare intended to improve the ability of a military to generate combat power. This is more than just technology and generally involves change at the operational level of war. According to the White House, this working group will likely seek to “accelerate our respective defense innovation enterprises and learn from one another, including ways to more rapidly integrate commercial technologies to solve warfighting needs.” ⁸¹ |
| Information Sharing | Increase the sharing of information between countries. According to the White House, this working group “will expand and accelerate sharing of sensitive information, including as a first priority enabling workstreams that underpin our work on agreed areas of advanced capabilities.” ⁸² |

production, maintenance, and related activities within the United States, Canada, the United Kingdom, Australia, and New Zealand.⁸³ But the NTIB is largely failing. There has been some progress in coordinating foreign investment reviews, but little has been achieved in facilitating export control processes.⁸⁴ As one study concludes, the NTIB “has not been utilized to foster industrial collaboration in any meaningful way and many have begun to question NTIB’s utility as a vehicle for such efforts.”⁸⁵

Finally, some of the United States’ “Buy America” provisions are generally counterproductive and undermine the ability to work closely with allies and partners who the United States will need in almost any conceivable war or military operation.⁸⁶ After all, modern weapons systems are products of a globalized market. Take the F-35 Lightning II combat aircraft program. Production and sustainment relies on 1,900 companies around the globe in 48 states and 10 countries.⁸⁷

Part of the challenge with reforming FMS and technology transfers to allies and partners in today’s international security landscape is that there are so many U.S. government agencies involved. Within the Department of Defense, examples include the DSCA, Defense Technology Security Administration, Office of the Secretary of Defense, Joint Staff, and military services. Within the Department of State, there are several offices within the Under Secretary for Arms Control and International Security and the regional bureaus. There are also other entities with various roles, such as the Department of Commerce and the Department of the Treasury. Within Congress, several committees have roles in FMS and technology transfer policies and procedures, such as the House and Senate Armed Services Committees, Senate Foreign Relations Committee, House Foreign Affairs Committee, and House and Senate Committees on Appropriations.

Resistance to Change

There are several reasons why some policymakers have resisted significant change.

First, some individuals and offices remain overly cautious about sharing sensitive technology with other countries—even to some of the United States’ closest allies with whom it shares its most sensitive intelligence. While the United States needs to prevent its sensitive technology from falling into the hands of its adversaries, such as China, Russia, and Iran, some of the concerns are anachronistic and counterproductive.

Second, some see a revitalization of the defense industrial base as giving money to greedy executives that produce deadly weapons systems. They also want more accountability for an industry they see as already engaging in waste, fraud, and abuse.⁸⁸ For example, *60 Minutes*, produced by CBS News, alleged that defense contractors had overcharged the Department of Defense for a wide array of defense equipment, potentially costing the U.S. government billions of dollars.⁸⁹ In addition, the Department of Defense’s Office of Inspector General found some instances of overcharging, including a pattern of behavior by the contractor TransDigm.⁹⁰ The House Committee on Oversight and Accountability summarized TransDigm’s actions as “rampant price gouging on mission-critical aircraft parts.”⁹¹ In May 2023, five senators alleged in a letter to the secretary of defense that some companies had “abused the trust government has placed in them, exploiting their position as sole suppliers for certain items to increase prices far above inflation or any reasonable profit margin.”⁹²


These accusations of fraud, waste, and abuse need to be taken seriously, and any individuals and companies found guilty need to be appropriately punished. The Department of Justice, Department of Defense’s Office of Inspector General, and other organizations are designed to conduct investigations and take necessary actions. But major waste, fraud, and abuse are the exceptions. In addition, closer inspection suggests that several of the charges leveled in the CBS News report, including price gouging, were inaccurate.⁹³ The outlier cases should not be an excuse for failing to strengthen the defense industrial base and improve technology transfers to key allies and partners.

Third, some policymakers oppose multiyear contracts because these types of contracts *commit* the government to fund the weapons systems or programs, reducing budget

flexibility in out years. Government agencies lose liquidity, and it can be more difficult to move money over the course of a fiscal year if a military service or other entity wants to shift priorities. Munitions are sometimes a “bill payer,” a part of the defense budget from which officials can trim to fund other programs.⁹⁴ Without multiyear contracts that guarantee funding, however, companies have little incentive to take financial risk and grow capacity. It’s not worth investing if there is unreliable demand. And the costs and risks are high. Multiyear contracts keep supply lines warm, sustain supply chain subcontractors, increase production efficiencies that help industry better respond to surges, and encourage investment in facilities and equipment.

A growing number of qualitative analyses and wargames suggest that the Department of Defense lacks key munitions stockpiles for a protracted conflict—or even a short one—in such theaters as the Indo-Pacific.⁹⁵ In today’s security environment, it increasingly makes sense for the government to take on more of the risk of buying weapons systems—perhaps even risking overbuying—because the risks associated with *underbuying* are so significant.

Consequently, the arguments opposed to revitalizing the defense ecosystem are largely unpersuasive, obsolete, and ultimately counterproductive in today’s competitive international landscape. As this chapter argues, the U.S. defense industrial base remains unprepared for the current security environment. The next chapter turns to possible solutions.



Multiyear contracts keep supply lines warm, sustain supply chain subcontractors, increase production efficiencies that help industry better respond to surges, and encourage investment in facilities and equipment.



CHAPTER 04

THE WAY AHEAD



The risks of failing to adequately revitalize the U.S. defense industrial base and broader defense ecosystem are significant and growing, especially with China putting significant resources into its defense industrial base and building advanced military capabilities. Without urgent changes, the United States could find itself with substantial supply and matériel shortfalls, which severely impact both deterrence and warfighting. The United States could also face a situation in which surge capacity lags, innovation stagnates, maintenance of critical supply chains is disincentivized, and the defense industrial base is underprepared for future stockpile requirements. The U.S. defense industrial base—led by a robust and strengthened commercial industry—needs to be a key pillar of broader U.S. industrial policy strategy to compete with China economically, technologically, and militarily.

The “peace dividend” that emerged at the end of the Cold War is over.¹ The international security environment has dramatically shifted. In February 2022, Russia invaded democratic Ukraine in a brazen move that has led to a protracted war of attrition. Since then, Russia has doubled down and ramped up defense production and imported weapons systems and components from such countries as China, Iran, and North Korea. In October 2023, Hamas conducted a bloody attack against Israel, and then Iranian-linked groups targeted U.S. and partner forces in Lebanon, Syria, Iraq, Yemen, and other countries. Iran and Iranian-linked groups possess a growing arsenal of sophisticated stand-off weapons, from missiles to unmanned aircraft

systems (UASs) and loitering munitions, which require improved air defense and counter-UAS capabilities. In the Indo-Pacific, China has become increasingly aggressive against Taiwan, the United States, and numerous countries in the region, such as Japan, Australia, and the Philippines. Finally, North Korea is expanding its arsenal of nuclear and conventional weapons, including intercontinental ballistic missiles, which threaten South Korea, the United States, and other countries.

China's defense industrial base is also increasingly operating on a wartime footing and is developing and producing weapons systems in all major domains—land, air, maritime, cyber, and space. As Secretary of the Air Force Frank Kendall remarked, “China has been reoptimizing its forces for great power competition and to prevail against the U.S. and the Western Pacific for over 20 years. . . . China has been building a military capability specifically designed to achieve their national goals and to do so even if opposed by the United States.”²

There is good news, however. The U.S. private sector is innovative, and the United States has a history of rejuvenating its defense sector in the face of authoritarian military action. U.S. revitalization has not just occurred during wartime, such as World War II or the Korean War, but also during times of increased strategic competition, such as during the 1960s, 1970s, and 1980s. In addition, a strengthened U.S. defense industrial base is good for U.S. jobs, since *every state* in the United States has workers in the defense sector.

This chapter provides recommendations to help revitalize the U.S. defense industrial base. It focuses on several areas: a White House-level initiative, defense production, and allies and partners. These recommendations are not intended to be comprehensive, but rather illustrative of the type of urgent changes necessary. There are many others worth considering, such as broad acquisition reform, strengthening economic security agreements, protecting against cyberattacks, improving international interoperability, and reducing the United States' reliance on China and other competitors for raw materials.³

China's defense industrial base is increasingly operating on a wartime footing and is developing and producing weapons systems in all major domains—land, air, maritime, cyber, and space.

White House-Led Effort

There is an urgent need for a presidential-led body to provide strategic guidance across government and to oversee a major revitalization of the defense industrial base and defense ecosystem. The Department of Defense cannot do it alone. The Department of State, Department of Commerce, Department of the Treasury, Congress, private sector, and other organizations also play important roles in the defense industrial base. Revitalization will likely not occur without White House leadership, as the history of the U.S. defense industrial base suggests.⁴

There are several options. One is a variant of the production boards that existed during the Roosevelt and Truman administrations. This body could be created by the president and could exercise general direction over U.S. defense procurement and production; help determine the policies, plans, and procedures of federal departments regarding procurement and production; establish priorities in the distribution of materials and services; break through bureaucrat gridlock; and provide a sense of urgency in revitalizing the defense industrial base. A second option is a variant of the Reagan administration's Emergency

Mobilization Preparedness Board, which was designed to improve mobilization capabilities and interagency cooperation within the federal government. The board might consist of representatives from key federal agencies at the deputy secretary or under secretary level, be chaired by the national security advisor, and include a full-time secretariat. A third option is the establishment of a national commission—composed of prominent former government officials, industry executives, and other subject-matter experts—designed to make recommendations to the U.S. president. A critical part of all of these options is to tie the body to the U.S. president.

Defense Production

Ramping up defense production should include several steps. An important goal should be for industry to produce high-volume and high-impact systems at affordable costs over time that help the United States strengthen deterrence and warfighting. Doing this will require shifting the *incentives* governing the defense industrial base on a range of issues, such as multiyear contracting.

Defense Spending: The United States likely cannot revamp its defense industrial base without increasing defense spending. The goal should be to increase funding for the development and production of critical weapons systems. An infusion of cash would strengthen the defense industrial base using Title 3 funds in the Defense Production Act, including such components as rocket boosters, energetics, engines, munitions, and new weapons systems. It might also be helpful for the government to increase investments in defense infrastructure, such as factories, which can be difficult and risky for industry to invest in quickly. One option might be to establish more government-owned, contractor-operated (GOCO) facilities. Amid the Cold War, the last major period of strategic competition, the U.S. defense budget hovered

between 9 and 11 percent of GDP during the Eisenhower administration, between 8 and 9 percent during Kennedy and Johnson administrations, and over 6 percent during the Reagan administration.⁵

This report has not conducted a comprehensive defense budget analysis. However, today's current defense budget of approximately 3 percent of GDP is not historically consistent with a security environment in which authoritarian states, such as China, Russia, Iran, and North Korea, are increasingly threatening the United States and its allies and partners. China, in particular, is developing a robust defense industrial base that is focused on warfighting and deterrence against the United States. In this environment, the United States needs to analyze defense budget options at least closer to the levels of the 1980s.⁶

Multiyear Contracting: The Department of Defense and Congress need to expand the use of multiyear procurement to create sustained demand signals that can promote investment into the capacity of the industrial base. These types of contracts have typically been reserved for only the most expensive acquisition types, such as procurement of large Navy ships. Multiyear procurement is a step in building a consistent and predictable demand signal that creates more transparency and less risk for both prime contractors as well as more fragile sub-tier suppliers. Reliance on cost savings *only* is too restrictive, and promoting defense industrial base stability and effective deterrence and warfighting is an important justification for multiyear contracts.

The fiscal year 2024 National Defense Authorization Act authorized multiyear procurement for some munitions, such as JASSM, Guided Multiple Launch Rocket System (GMLRS), LRASM, and PAC-3. While helpful, the problem has generally not been the authorization of multiyear contracts, but rather the failure of appropriators or the military services to fund or spend multiyear contracts. Appropriators need to *fund*—and the services need to *spend*—critical munitions important for warfighting and deterrence in the Indo-Pacific, Europe, and Middle East. There are several munitions that should be considered for future multiyear funding, such as the AGM-179 Joint Air-to-Ground Missile (JAGM), Javelin, Precision Strike Missile (PrSM), AGM-88G Advanced Anti-Radiation Guided Missile Extended Range (AARGM-ER), AIM-120 Advanced Medium-Range Air-to-Air Missile (AMRAAM), and Harpoon.

The Department of Defense and Congress need to expand the use of multiyear procurement to create sustained demand signals that can promote investment into the capacity of the industrial base.



Strategic Stockpiles: The Department of Defense maintains stockpiles of some key minerals, munitions, chemicals, technology, and medical supplies. But it needs to better manage inventory and stockpile planning to decrease near-term risk and mitigate supply chain vulnerabilities. It also needs to stockpile (or develop alternative markets for) such critical minerals as antimony, titanium, nickel, and cobalt. For example, the United States imports a significant amount of titanium sponge from Russia and China, which could be cut off or interrupted in a war.⁷

The Department of Defense and Congress should allocate additional funding for contracts and other incentives—such as tax incentives, regulatory relief, and long-term contracts—to build and maintain spare production capacity. Such funding should be used to modernize and expand facilities and develop flexible production. The Department of Defense and Congress should also increase funding to expand domestic production of components critical for deterrence and warfighting in such areas as the Indo-Pacific, such as cruise missile motor capacity expansion (which is important for Harpoon, Tomahawk, LRASM, JASSM, and other long-range missiles), solid rocket motor capacity expansion, energetics, and batteries.

Working with industry partners, the Department of Defense should also identify and establish stockpiles of the critical parts, finished goods, and commodities needed to meet production requirements for conducting sustained military campaigns against adversaries. In addition, the Department of Defense should identify the

stockpiling requirements of critical minerals and components necessary to continue production in cases where international conflict or crisis may inhibit normal functioning of supply chains. The essential role of these stockpiles should be to mitigate supply chain vulnerabilities and ensure the military's operational freedom and effectiveness. One example is the field-programmable gate array chips that are manufactured in Taiwan and extensively used in U.S. weapons systems, such as F-35s, missiles, and command and control equipment. It will take years to set up the production capability in the United States, so the U.S. government needs to stockpile these chips in case of a Taiwan contingency.

Improvements to the Workforce and Supply Chains: The United States needs to diversify the supplier base and invest in new or different production methods. For example, defense companies could increasingly use cast iron processes, rather than forging. Casting is generally less expensive and more versatile than forging, though it has some potential disadvantages such as less resistance to wear.

The Department of Defense should look for opportunities to assist companies with upskilling and reskilling workers by offering incentives. Examples of such actions include the following:

- » Expand investments in the Department of Defense's Manufacturing Innovation Institutes, including by supporting public-private partnerships with colleges, universities, high schools, and other institutions.
- » Invest in institutions and programs that support workforce development to address skill gaps in defense-related manufacturing and science, technology, engineering, and mathematics (STEM) jobs.
- » Expand programs such as Project MFG, photonics certifications, IDREAM4D, the Microelectronics Security Training Center, and Scalable Asymmetric Lifecycle Engagement. The Department of Defense helped

establish these programs to support the talent needed for defense-related manufacturing and STEM jobs.

- » Increase federal funding for vocational schools that train individuals for defense workforce jobs, such as shipyard welders.

The Department of Defense should also consider increasing the use of defense industrial base programs, such as Defense Production Act Title III, to incentivize the expansion of existing U.S. sources and the establishment of new ones.⁸ The secretary of the Navy's maritime statecraft initiative outlines an approach to revitalize commercial shipbuilding by using long-dormant subsidies and other steps to invest in commercial shipyards in the United States, modernize and expand shipbuilding industrial capacity, and develop a more capable and competitive workforce.⁹

Allies and Partners

The White House needs to focus significant attention on improving and streamlining the Foreign Military Sales (FMS), International Traffic in Arms Regulations (ITAR), and other processes and procedures across the U.S. government to expand co-development, co-production, co-sustainment, and other types of cooperation with critical allies and partners in Europe and the Indo-Pacific. Significant progress will not happen without White House-level intervention.

For FMS, the Department of Defense should develop a more efficient review process for releasing technology, provide allies and partners with relevant priority capabilities, accelerate acquisition and contracting support, and ensure broad U.S. government support to improve the FMS process. The Defense Security Cooperation Agency, working with the services and military departments, should establish a rapid contracting process to reduce the backlog in getting approved FMS cases on contract.¹⁰ The Department of State should consider instituting internal deadlines for bureaus and offices to respond to FMS requests. These deadlines should be standard

and understood by stakeholders outside of the Department of State.

Congressional notifications for FMS should include the date on which the United States received an official request from the partner nation for the times and services included in the notification. This would allow members to understand just how long international partners are waiting for replies to requests. The date used should be the date on which the letter of request was first received by a U.S. security cooperation organization, such as the in-country Security Cooperation Office, the Defense Security Cooperation Agency, combatant command staff, or service implementing agency.

On technology cooperation, the administration should also move quickly to put in place regulations that will provide broad exemptions for the United Kingdom and Australia, much like the United States has provided to Canada. In addition, the U.S. government should increase co-production, co-development, and other arrangements with key allies and partners in such areas as munitions, shipbuilding, and ground vehicles. For example, South Korea and Japan have robust shipbuilding capabilities through companies, such as Daewoo, Hyundai Heavy Industries, Mitsubishi Heavy Industries, and Imabari Shipbuilding, that could be useful. There have been several recent examples of co-production with allies and partners, such as the High Mobility Artillery Rocket System (HIMARS) with Poland, Precision Strike Missile (PrSM) and GMLRS with Australia, Naval Strike Missile with Norway, and SM-6 components and Tomahawks for Japan and Australia. But these examples are the exception rather than the rule.

Doing this effectively will require limiting "Buy America" protectionism, especially for allies that the United States may need to operate and fight with in future military contingencies. Expanding reciprocal defense procurement (RDP) agreements with allies could be helpful. The United States has RDP agreements with Australia and Japan, but not with South Korea. Such provisions as the Merchant Marine Act of 1920 (better known as the Jones Act) have made it difficult, if not impossible, for the United States to effectively collaborate in such areas as shipbuilding with Japanese, South Korean, or other allies that have sufficient capacity.¹¹ The act is archaic and counterproductive in a world where defense collaboration is increasingly important with U.S. allies.

Following Russia's invasion of Ukraine, the United States was involved in setting up recurring engagements with the heads of the ministries of defense and national armaments directors to coordinate support efforts. This body jump-started initiatives to expand ammunition production, establish an international support fund, and organize the delivery and sustainment of critical capabilities. The United States should consider convening the leadership of allied and partner nations within the Indo-Pacific, such as Australia, Japan, and South Korea, to deepen multilateral collaboration on regional industrial base and manufacturing production challenges.

The recommendations outlined in this chapter would go a long way to revitalize the U.S. defense industrial base in a competitive security environment. Key recommendations include developing a White House-level body to oversee revitalization of the defense industrial base; ramping up defense production in such areas as multiyear contracting, strategic stockpiles, supply chains, and the workforce; and improving defense industrial cooperation with partners and allies. Unless these types of urgent changes occur, the United States risks weakening deterrence and undermining its warfighting capabilities in the Indo-Pacific, Europe, and other regions against China and other competitors, including Russia, Iran, and North Korea.

The United States has the tools to reinvigorate its industrial base, including an innovative and technologically advanced private sector. The United States has also been in similar positions before—and succeeded. It is worth quoting at length President Franklin Delano Roosevelt's December 1940 speech—one year before Pearl Harbor—arguing that the United States needs to be an arsenal of democracy. Roosevelt's words are highly relevant today:

I want to make it clear that it is the purpose of the nation to build now with all possible speed every machine, every arsenal, every factory that we need to manufacture our defense material. We have the men, the skill, the wealth, and above all, the will. I am confident that if and when production of consumer or luxury goods in certain industries requires the use of machines and raw materials that are essential for defense purposes, then such production must yield, and will gladly yield, to our primary and compelling purpose.

So I appeal to the owners of plants, to the managers, to the workers, to our own government employees to

put every ounce of effort into producing these munitions swiftly and without stint. With this appeal I give you the pledge that all of us who are officers of your government will devote ourselves to the same whole-hearted extent to the great task that lies ahead.

As planes and ships and guns and shells are produced, your government, with its defense experts, can then determine how best to use them to defend this hemisphere. The decision as to how much shall be sent abroad and how much shall remain at home must be made on the basis of our overall military necessities.

We must be the great arsenal of democracy.

For us this is an emergency as serious as war itself. We must apply ourselves to our task with the same resolution, the same sense of urgency, the same spirit of patriotism and sacrifice as we would show were we at war.¹²

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Executive Summary

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