

EMPTY BINS IN A WARTIME ENVIRONMENT

The Challenge to the U.S. Defense Industrial Base

AUTHOR
Seth G. Jones

A REPORT OF THE
CSIS International Security Program

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Tip: Before the demolition or reinstallation of the quick-change connectors, you should turn off the forklift and pull the shutoff the four handles to release the pressure of the hydraulic oil.

CHAPTER 01

INTRODUCTION

**Servicemen of the Ukrainian military forces
move U.S.-made FIM-92 Stinger missiles
and other military assistance to Kyiv.**

SOURCE Sergei Supinsky/AFP/Getty Images



The U.S. defense industrial base is not adequately prepared for the competitive security environment that now exists. It is currently operating at a tempo better suited to a peacetime environment. In a major regional conflict—such as a war with China in the Taiwan Strait—the U.S. use of munitions would likely exceed the current stockpiles of the U.S. Department of Defense (DoD), leading to a problem of “empty bins.”

According to the results of a series of CSIS war games, for instance, the United States would likely run out of some munitions—such as long-range, precision-guided munitions—in *less than one week* in a Taiwan Strait conflict. These shortfalls would make it extremely difficult for the United States to sustain a protracted conflict—and, equally concerning, the deficiencies undermine deterrence.¹ They also highlight that the U.S. defense industrial base lacks adequate surge capacity for a major war. These problems are particularly concerning since China 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.²

In addition, some U.S. programs and regulations, such as the U.S. Foreign Military Sales (FMS) program and International Traffic in Arms Regulations (ITAR), are outdated for a wartime environment and need to deliver weapons systems more rapidly to key allies and partners. Growing strategic competition with countries such as China and Russia, which are attempting to export weapons systems and technology, threatens to offset the United States’ competitive advantage.

The U.S. defense industrial base is not adequately prepared for the competitive security environment that now exists. It is currently operating at a tempo better suited to a peacetime environment.



The war in Ukraine has also exposed serious deficiencies in the U.S. defense industrial base. U.S. assistance to Ukraine has been critical to halting Russian revanchism and sending a message to China about the costs and risks of aggression—and needs to continue. But it has also depleted U.S. stocks of some types of weapons systems and munitions, such as Stinger surface-to-air missiles, 155 mm howitzers and ammunition, and Javelin anti-tank missile systems (especially the command launch units). The United States has been slow to replenish its arsenal, and the DoD has only placed on contract a fraction of the weapons it has sent to Ukraine.³ Many U.S. allies and partners in Europe also have defense industrial bases that are unprepared for major war, heavily reliant on the United States, and chronically underfunded.⁴

The history of industrial mobilization suggests that it will take years for the defense industrial base to produce and deliver sufficient quantities of critical weapons systems and munitions and recapitalize stocks that have been used up. It might take even longer to materialize facilities, infrastructure, and capital equipment, making it important to make changes *now*.⁵ The long timelines are manageable in peacetime but not in the competitive environment that now exists. The U.S. military services have underinvested in weapons systems and munitions for a conventional war, and the DoD's acquisition system faces challenges in creating the incentives for industry to invest in sufficient stockpiles of key weapons systems.

As the war in Ukraine illustrates, a war between major powers is likely to be a protracted, industrial-style conflict

that needs a robust defense industry able to produce enough munitions and other weapons systems for a protracted war if deterrence fails. Effective deterrence hinges, in part, on having sufficient stockpiles of munitions and other weapons systems. These challenges are not new.⁶ What is different now, however, is that the United States is directly aiding Ukraine in an industrial-style conventional war with Russia—the largest land war in Europe since World War II—and tensions are rising between China and the United States in the Indo-Pacific. Timelines for a possible war are shrinking.

To better understand the scale, scope, and implications of these challenges, this study asks several questions. First, what is the production capacity of the U.S. defense industrial base in light of U.S. aid to Ukraine? Second, what are implications for U.S. involvement in one or more major theater wars, including the state of U.S. stockpiles of key weapons systems and munitions? Answers to this second question need to consider the state of contracts, stresses on the supply chain, inflation, and time requirements needed to meet surging demands. Third, how have FMS and other policies and regulations helped fill gaps, and what are the main challenges? Fourth, what are possible solutions to help fix these challenges? In short, the goal of this study is to briefly highlight current challenges, suggest possible next steps, and encourage more research and analysis—including with additional data—about defense industrial base issues and possible solutions.

To answer these questions, this study relied on several sources of information. It collected and analyzed publicly available data on weapons systems and munitions, including data compiled by the DoD. It also relied on interviews with dozens of officials from the DoD, Congress, the defense industry, and subject matter experts. Finally, the study utilized

the results of war games and other analyses, including those conducted by CSIS.

The rest of this study is divided into four sections. It begins by examining the status of the U.S. defense industrial base in light of the Ukraine war. It then examines the implications for one or more major theater wars, with a particular focus on the munitions industrial base. Next, it assesses FMS and support to the defense industrial base. Finally, the study outlines potential recommendations to fix identified problems.



CHAPTER 02

UKRAINE AND THE GREAT AWAKENING

A Ukrainian artilleryman throws an empty 155 mm shell tube as Ukrainian soldiers fire a M777 howitzer toward Russian positions.

SOURCE Anatolii Stepanov/AFP/Getty Images



U.S. military assistance to Ukraine—along with aid from U.S. allies and partners—has been critical in allowing the Ukrainian military to prevent a Russian overthrow of the government and in helping Ukraine conduct offensive and defensive military operations. U.S. military assistance has included over \$24 billion and hundreds of weapons systems and munitions—from M142 High Mobility Artillery Rocket System (HIMARS) launchers to Javelins.⁷ This assistance—along with training, intelligence, and other U.S. and Western aid—has helped Ukraine defend itself; provided Ukraine with the tools to retake some territory from Russian forces in Kharkiv, Kherson, Donetsk, Luhansk, and other oblasts; and highlighted the potential costs and risks for China of military action in the Indo-Pacific.⁸ U.S. and other Western aid should continue in order to prevent Russia from retaking Ukrainian territory in the future, dissuade Russian aggression elsewhere, and deter Chinese military aggression.

Nevertheless, battlefield consumption rates in Ukraine have strained the defense industrial base to produce sufficient quantities of some munitions and weapons systems. Since many of the weapons systems and munitions have come directly from U.S. inventories, U.S. assistance has depleted some stockpiles that could be used for training, future contingencies, or other operational needs.⁹

For example, the quantities of Javelins transferred to Ukraine through late August 2022 represented seven years of production at fiscal year (FY) 2022 rates before recent reprogramming actions.¹⁰ The number of Stingers trans-

ferred to Ukraine is roughly equal to the total number built for all non-U.S. customers in the last 20 years.¹¹ One of the most lethal weapons the United States has sent are 155 mm howitzers that fire high-explosive ammunition weighing about 100 pounds each and are able to hit targets nearly 20 miles away. As of January 2023, the U.S. military has provided Ukraine with up to 1,074,000 rounds of 155 mm ammunition, significantly shrinking the availability of 155 mm rounds in storage.¹² Because of the limited availability of 155 mm howitzers and ammunition, the U.S. military began sending 105 mm howitzers and ammunition instead.¹³

As Figure 1 shows, the problem of depleted stockpiles—or “empty bins”—is not uniform. In some instances—such as M113 armored personnel carriers and 105 mm howitzers—the amounts given to Ukraine are relatively small compared to U.S. inventories and production capabilities. But in other cases—such as Javelins (particularly the Javelin’s command launch unit), Stingers, 155 mm howitzers and ammunition, and counter-artillery radar—transfers to Ukraine and procurement rates suggest that inventories for some systems are low.

Despite these challenges, there is some good news. There are early signs of a “Great Awakening” about the state of the U.S. defense industrial base—especially the munitions industrial base—in light of U.S. assistance to Ukraine. Senior U.S. defense officials, such as Undersecretary of Defense for Acquisition and Sustainment William LaPlante, have publicly acknowledged industrial base challenges and outlined steps to help fix them.¹⁴ U.S. Army officials such as Christine Wormuth, secretary of the army, and Doug Bush, assistant secretary of the army for acquisition, logistics and technology, have committed to tripling the production of 155 mm shells over the next few years.¹⁵ The U.S. Army also awarded a \$431 million contract for full-rate production of HIMARS to support the U.S. Army and several U.S. partners overseas.¹⁶

In addition, the FY 2023 National Defense Authorization Act was a helpful step by authorizing the DoD to establish multiyear contracts for some munitions that are critical to aid Ukraine and, potentially, Taiwan. Examples include Patriot Advanced Capability-3 (PAC-3) missile segment enhancement interceptors, FIM-92 Stingers, AIM-120 Advanced Medium-Range Air-to-Air Missiles (AMRAAMs), 155 mm rounds, long-range anti-ship missiles (LRASMs),

Joint Air-to-Surface Standoff Missiles (JASSMs), Standard Missile-6 missiles (SM-6), and Sidewinder missiles (AIM-9Xs).¹⁷

But problems remain. As a DoD study concluded, one difficulty includes “onerous business processes and regulations” in which DoD accounting requirements and other actions create “imposing uncompensated additional costs compared to more profitable commercial procurement opportunities.”¹⁸ Years of acquisition policy, culture, and behavior have prioritized efficiency and cost control over speed and capacity, and it will take time to find a more appropriate balance.

In some cases, there are discussions between industry and the U.S. military—including the services—about new purchases. But inquiries do not always turn into contracts, which generally happen through the Planning, Programming, Budgeting, and Execution (PPBE) process.¹⁹ The Pentagon’s buying process generally starts with the military determining its requirements, which are then reviewed before bids are solicited from the private sector. But since Russia’s invasion of Ukraine in February, the Pentagon has not always communicated those requirements clearly, which often change. These changes create delays and leave defense contractors unable to prepare for more production.²⁰

The United States is working simultaneously to replenish Stinger stocks and replace the Stinger with a follow-on, next-generation interceptor for short-range air defense capability. But both replenishment and replacement have been slow.²¹ BAE Systems is considering restarting production of the M777 155 mm howitzer following possible renewed interest from the U.S. Army and several foreign countries. To make the business case for restarting production of the M777 155 mm howitzer, however, BAE Systems would likely need at least 150 unit orders over several years.²² In addition,

SYSTEM	MANUFACTURER	STATUS OF PRODUCTION LINE	NUMBER COMMITTED TO UKRAINE	STATUS OF U.S. INVENTORY
Javelin anti-armor systems	Raytheon/Lockheed Martin	Active	Over 8,500	Low, particularly for command launch unit
Stinger anti-aircraft systems	Raytheon	Semi-active	Over 1,600	Low
155 mm howitzers	BAE Systems and other manufacturers	Semi-active	160	Low
155 mm artillery rounds	General Dynamics and other manufacturers	Active	Up to 1,074,000	Low, and U.S. policy prohibits exporting cluster munitions with a dud rate greater than 1 percent
Excalibur precision-guided 155 mm rounds	Raytheon	Active	5,200	Medium
Counter-artillery radars	Raytheon	Active	Over 50	Low
M113 armored personnel vehicles	BAE Systems	Closed	300	Medium
105 mm howitzers	Rock Island Arsenal	Closed	72	Medium
105 mm artillery rounds	BAE Systems and other manufacturers	Active	275,000	High
Harpoon coastal defense systems	Boeing	Active	2	Medium, though current U.S. inventories may not be sufficient for wartime
High Mobility Artillery Rocket Systems (HIMARS)	Lockheed Martin	Active	38	Medium
Small arms ammunition	Various manufacturers	Active	Over 108,000,000	High

the United States has provided Switchblade 600s to Ukraine, but Switchblades are still in development and not yet a program of record with plans for production.²³ Low numbers of munitions and related systems pose risks to U.S., allied, and partner forces, which need them to equip deploying units, train forces, and ensure sufficient maintenance pipelines.²⁴ Unlike most of the commercial sector, there is only one domestic customer in the United

FIGURE 1 Status of Selected Weapons Systems and Munitions Provided to Ukraine

SOURCE CSIS estimates; “Fact Sheet on U.S. Security Assistance to Ukraine,” U.S. Department of Defense, January 6, 2023, <https://media.defense.gov/2023/Jan/06/2003141218/-1/-1/1/UKRAINE-FACT-SHEET-JAN-6.PDF>; and Mark Cancian, “Is the United States Running Out of Weapons to Send to Ukraine?” CSIS *Commentary*, September 16, 2022, <https://www.csis.org/analysis/united-states-running-out-weapons-send-ukraine>. Data through January 6, 2023.

States for weapons systems—the U.S. military—creating a monopsony (a market situation where there is only one buyer). Once orders drop off, manufacturers may close production lines to cut costs, unless there are options for foreign sales. Small businesses may exit the defense sector or close entirely. Supply chain issues can also be challenging because components or sub-components may be produced by a subcontractor that goes out of business or retools for other customers. A subcontractor may also rely on parts from overseas companies that have other priorities, face sanctions by the U.S. government, or are owned by—or situated in—hostile countries.²⁵

More broadly, the war in Ukraine has demonstrated that competition and conflict between major powers will require a strong industrial base in the United States and in key ally and partner countries. The effort to deploy, arm, feed, and supply forces is a monumental task, and the massive consumption of equipment, systems, vehicles, and munitions requires a large-scale industrial base for resupply.²⁶ Ukraine also suggests that war between major powers—as well as credible deterrence—will likely require several specific types of weapons systems, such as long-range strike from air, land, and maritime platforms.

To be clear, the problem is not U.S. assistance to Ukraine. U.S. and Western aid are essential to prevent Moscow from seizing additional territory in Ukraine and deter future military aggression by Moscow and Beijing. In most cases, the types of weapons systems needed in a U.S. war with China in the Indo-Pacific (which would likely be an air-sea war) are not the same as those the United States is providing to Ukraine (which is primarily an air land war). For example, a war in the Indo-Pacific faces a tyranny of distance. Guam is 1,600 miles from Taiwan and Hawaii is over 5,000 miles. The main problem is that the U.S. defense industrial base—including the munitions industrial base—is not currently equipped to support a protracted conventional war.

The war in Ukraine has demonstrated that competition and conflict between major powers will require a strong industrial base in the United States and in key ally and partner countries.



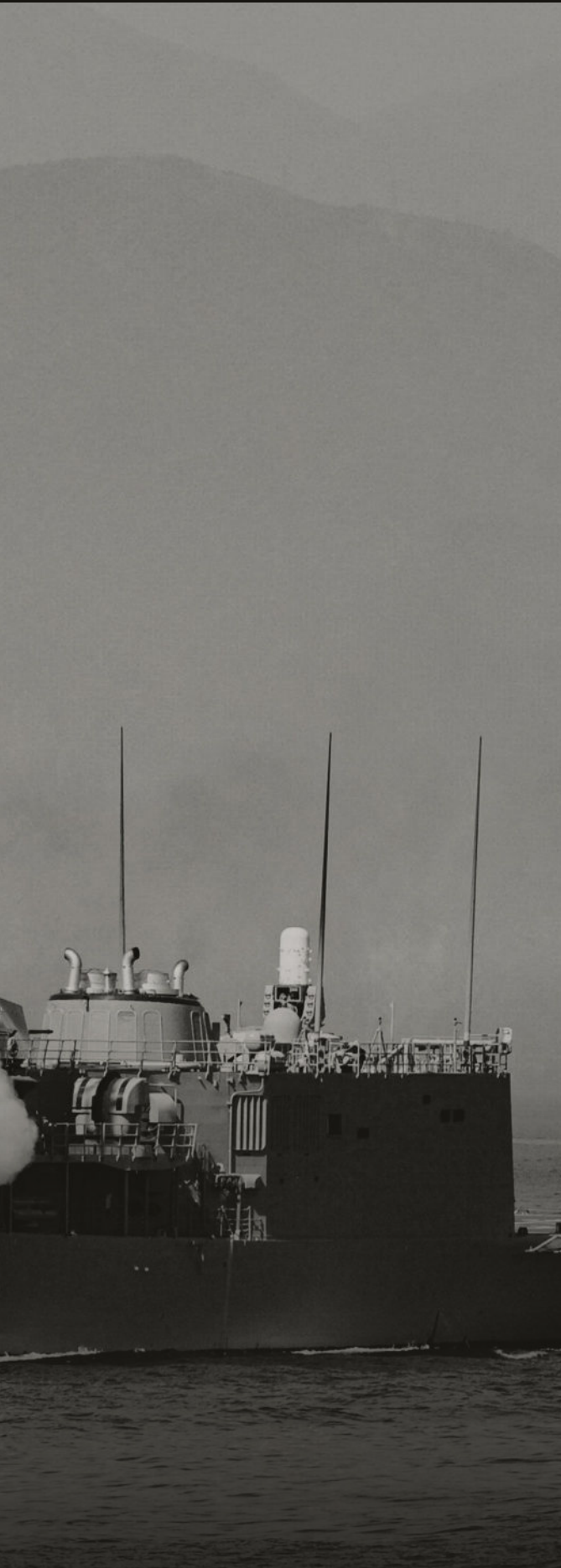


CHAPTER 03

EMPTY BINS AND MAJOR WAR

Taiwanese navy launches a U.S.-made Standard Missile from a frigate during the annual Han Kuang Exercise on July 26, 2022.

SOURCE Sam Yeh/AFP/Getty Images



Ukraine is only a small part of the picture. A more disturbing challenge is the state of the industrial base for one or more future wars, including in the Indo-Pacific. With growing competition between the United States and China—along with continuing threats from Russia, Iran, North Korea, and terrorist groups—the U.S. military needs to be prepared to fight at least one major war, if not two.²⁷

The requisite capabilities for fighting are essential for a credible deterrent. There are two main types of deterrence in the context of this study. Deterrence by denial involves preventing an adversary from taking an action by making the action infeasible or unlikely to succeed, thus denying the adversary confidence in achieving its objectives. Deterrence by punishment involves preventing an adversary from taking an action by imposing severe costs if the action occurs.²⁸ In both cases, a strong U.S. industrial base—with sufficient munitions stockpiles and weapons systems—is critical for deterring Chinese action.

Yet the United States is not prepared for war, which undermines deterrence. With Xi Jinping in his third term, most likely confident and emboldened, it is unclear what the timelines are for a Chinese invasion of Taiwan—if it happens. For planning purposes, the United States needs to be ready *now*.²⁹ As the February 2022 Russian invasion of Ukraine highlighted, it is difficult to predict timelines months or years ahead of time. Given the lead time for industrial production, it would likely be too late for the defense industry to ramp up production if a war were to occur without major changes.

Major regional conflicts will expend significant quantities of munitions, likely exceeding current DoD planning efforts. In nearly two dozen iterations of a CSIS war game 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: 4,000 JASSMs, 450 LRASMs, 400 Harpoons, and 400 Tomahawk land-attack missiles (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. The same is true of ship-based munitions, such as the SM-6, which would be expended in large quantities.

LRASMs offer a useful case study. In every iteration of the war game, the United States expended its inventory of LRASMs within the first week of the conflict. These missiles were particularly useful because of their ability to strike Chinese naval forces from outside the range of Chinese air defenses. As the war game showed, Chinese defenses are likely to be formidable—especially early on in a conflict—thus preventing most aircraft from moving close enough to drop short-range munitions. Bombers used in the war game generally employed these munitions because they could be based outside of the range of Chinese missiles.³⁰ The B-21 Raider, which has long-range strike capabilities, will likely be an exception when it becomes operational over the next several years.

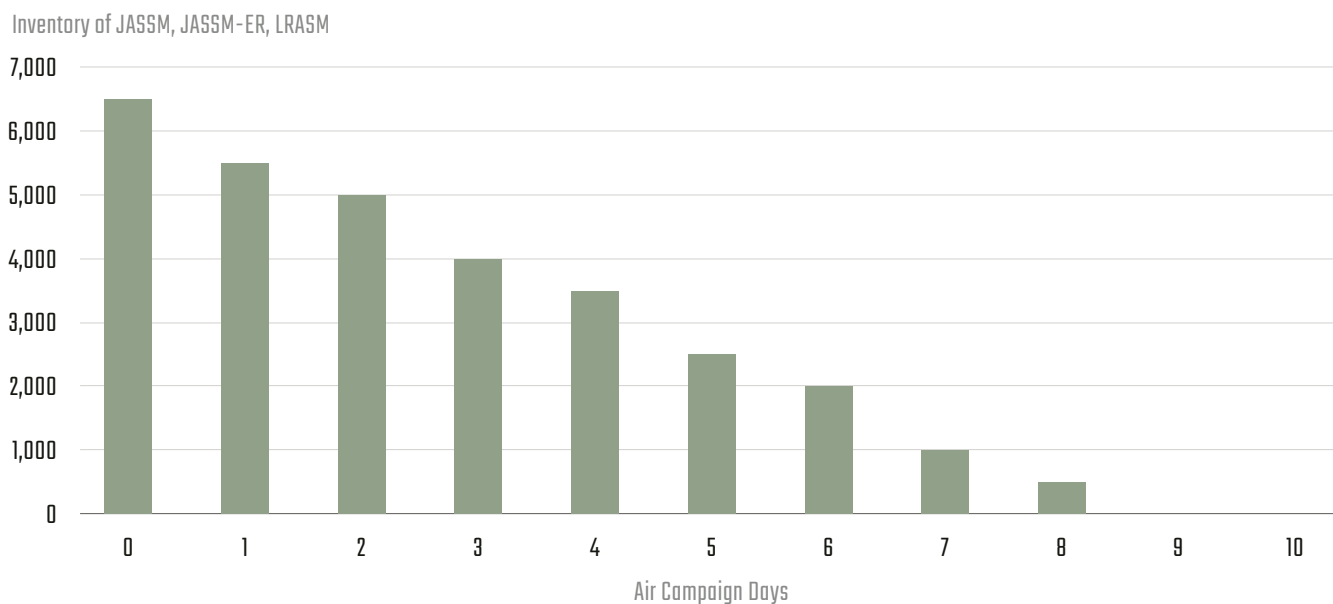
In addition, it takes nearly two years to produce LRASMs, creating a time lag to fix the shortfall.³¹ The FY 2023 budget

proposes buying only 88 LRASMs.³² Figure 2 shows the results of one analysis of munitions inventories during a possible future air campaign.³³ Much like in CSIS's war games, it shows how LRASM, JASSM, and Joint Air-to-Surface Standoff Missile-Extended Range (JASSM-ER) inventories the U.S. Air Force may produce in the future could be depleted in a war against a major power in roughly one week.³⁴

A future war will also likely be different from past and current wars. For example, the war in Ukraine illustrates the growing use of unmanned aircraft systems (UASs) for domain awareness, early warning, targeting for standoff attacks, strike, electronic warfare, and information operations.³⁵ Future wars may include various types of loitering munitions, unmanned underwater vehicles, hypersonic missiles, and other weapons systems that could impact U.S. and allied production and stockpiling.

FIGURE 2 Use of Munitions in a Possible Air Campaign

SOURCE Mark A. Gunzinger, "Affordable Mass: The Need for a Cost-Effective PGM Mix for Great Power Conflict," Mitchell Institute for Aerospace Studies, November 2021, 19, https://mitchellaerospacepower.org/wp-content/uploads/2021/11/Affordable_Mass_Policy_Paper_31-FINAL.pdf.



The United States is not the only country facing a munitions challenge. In a recent war game involving U.S., UK, and French forces, titled Warfighter 21-4, the United Kingdom's 3rd Division exhausted national stockpiles of critical munitions in just over a week.³⁶ U.S. lieutenant general (ret.) Ben Hodges, former commanding general of U.S. Army Europe, remarked that "in about eight days of exercise, every bit of important ammunition in the British Army's inventory was expended." He continued that the United States and its allies "absolutely do not have enough of the critical munitions that we need, especially what is called the preferred munitions—the ones that are precise in targeting."³⁷ Other analyses have come to similar conclusions.³⁸

The problem is not just running out of munitions, which is challenging enough. Unlike in Ukraine, where the country's western border is wide open for weapons shipments, Taiwan is an island. A Chinese blockade and long-range fire capabilities will make it difficult—and perhaps impossible—to get weapons systems and munitions into the area once war has started. A war in the Indo-Pacific will likely require more long-range munitions, as well as a greater inventory of munitions in theater to account for the difficulty of flowing munitions in once a war has started.

There are several challenges with quickly fixing some of these problems.

First, defense companies are generally unwilling to take financial risks without contracts—including multiyear contracts—in place. It is not a sound business decision to build more munitions or weapons systems without a clear demand signal and financial commitments, especially given the large capital investment and personnel requirements.³⁹ This risk aversion is compounded if companies have to make additional capital investments—espe-

cially investments for facilities, infrastructure, and tooling. As one DoD study concluded, "Producers benefited 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 [defense industrial base]."⁴⁰ There has been an inconsistent demand signal from the DoD to build up stockpiles, which risks production lines being shut down.⁴¹ 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 DoD signs multiyear contracts for ships and airplanes, it does not sign multiyear contracts for most munitions. In 2022, the DoD requested congressional approval to reprogram some of its funds to increase production capabilities for HIMARS, Guided Multiple Launch Rocket Systems (GMLRS), and 155 mm ammunition.⁴² While this is a step in the right direction, the DoD needs to consider making commitments for multiyear acquisitions to justify industry investment in surge capabilities, including necessary infrastructure.⁴³ After all, the services—such as the U.S. Navy and Marine Corps—sometimes cut munitions from their budgets to make room for platforms and other priorities or to fix problems that arise during the acquisition of those systems.⁴⁴

Second, there are also workforce and supply chain constraints to increase the supply of weapons systems and munitions required for major war. Companies need to hire, train, and retain workers. The DoD needs healthy, resilient, diverse, and secure supply chains to ensure the development and sustainment of important capabilities.⁴⁵ Supply chains for the U.S. defense sector are also not as secure as they should be, with some businesses shutting down or moving supply chains overseas to unfriendly countries. Notable vulnerabilities include kinetic capabilities (such as hypersonic weapons technology and directed energy weapons), energy storage and batteries, castings and forgings, and microelectronics.⁴⁶

In some cases, there are single sources for key components and sub-components. The Javelin, for instance, relies on a rocket motor—the Aerojet Rocketdyne's advance

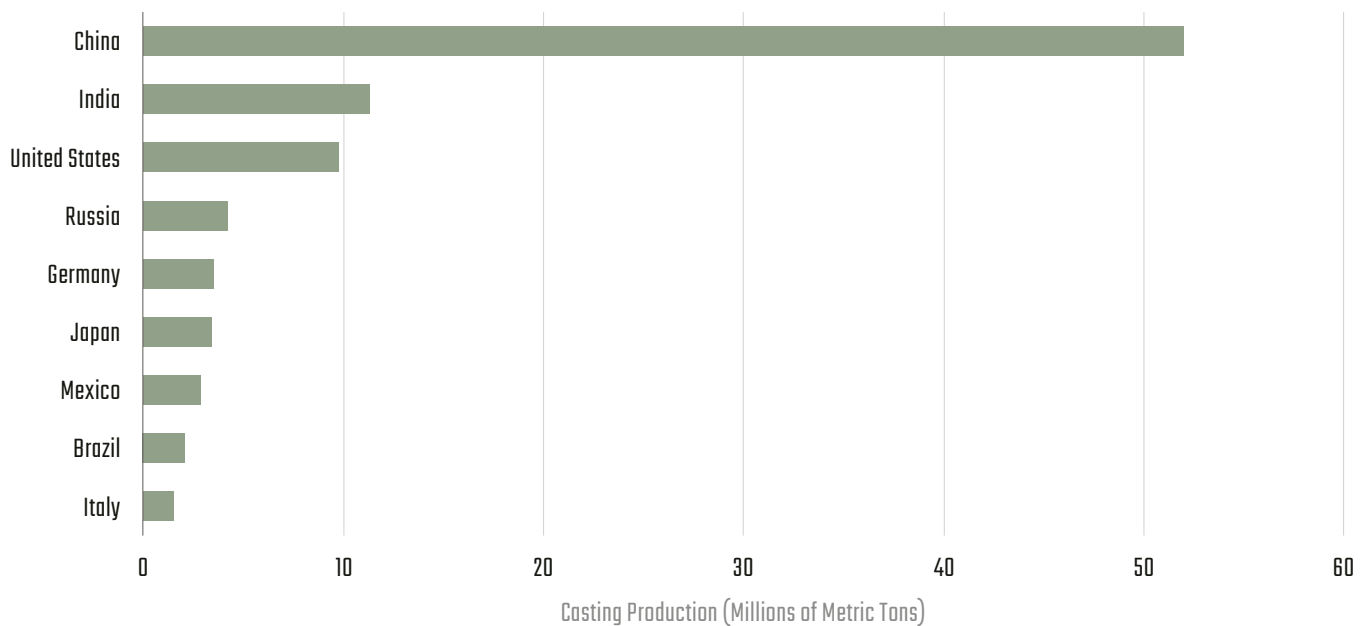


FIGURE 3 Volume of Global Casting Production by Country

SOURCE “Volume of Global Casting Production from 2018 to 2020, by Country,” Statista, April 26, 2022, <https://www.statista.com/statistics/237526/casting-production-worldwide-by-country/>.

solid-propellant rocket motor—without a second source at the moment. There is one company, Williams International, that builds turbofan engines for most cruise missiles, such as the JASSM, JASSM-ER, and LRASM. There is also one main company, PacSci EMC, that produces the energetics for most missiles.⁴⁷ There is one foundry that can produce the large titanium castings for some important weapons systems.⁴⁸

There are also significant vulnerabilities with some rare-earth metals, which China has a near monopoly on, that are critical for manufacturing various missiles and munitions.⁴⁹ China dominates the advanced battery supply chain across the globe, such as lithium hydroxide, cells, electrolyte, lithium carbonate, anodes, and cathodes.⁵⁰ As Figure 3 shows, China is the global leader in cast products and produces more than the next nine countries combined, including over five times as much as the United States.⁵¹ The DoD depends on foreign governments, including China, for large cast and forged products, which are utilized in some defense systems and machine tools and manufacturing systems on which the department is dependent.⁵²

In addition, there are supply chain vulnerabilities with titanium, aluminum, and other metals; semiconductors; missile propulsion; high-temperature materials; and a range of microelectronics.⁵³ Several industrial sites—such as the Holston Army Ammunition Plant in Kingsport, Tennessee, and the missile plant in Troy, Alabama—produce capabilities that have few or no substitutes. A future war with China over Taiwan could also trigger a global shortage of semiconductors with broad ramifications, including upsetting chip supply and demand dynamics, creating cost spikes, and causing supply chain shortages.

Third, lead time is a significant constraint. According to one CSIS study, for example, it would take an average of 8.4 years to replace Major Defense Acquisition Program (MDAP) inventories at surge production rates.⁵⁴ Missiles, space-based systems, and shipbuilding face the longest replacement times. As Figure 4 shows, it can take roughly two years to produce some types of missiles—such as the PAC-2/PAC-3 air and missile defense system, Tomahawk Block V, JASSM, and PrSM long-range precision strike missile. These lead times are generally to deliver the *first* missiles—not the *last* ones.

Filling inventories requires sustained multiyear investment as well as accurate projections of the rate of use. Missile obsolescence, tooling, and sub-tier capacity have not been a priority and are a major constraint.

In addition, it can take *at least* 18 to 24 months to implement investments in some factories to develop capacity to meet surging demands.⁵⁵ Lead times have increased with Covid-19, the war in Ukraine, and personnel challenges such as hiring and retention. Inspections, shipping, and logistics can impact lead time as well.

There are also potential challenges in expanding some facilities, such as munitions assembly plants, since companies are required to have sufficient standoff space—or “quantity-distance”—between the plant and surrounding area to protect civilians from accidental explosions. Building a larger plant can involve purchasing additional land, securing permits, buying addi-

tional insurance, and taking other steps that require time and money.⁵⁶ There are also only a few munitions assembly plants, such as Camden, Arkansas; Huntsville, Alabama; Rocket Center, West Virginia; and Elkton, Maryland.⁵⁷

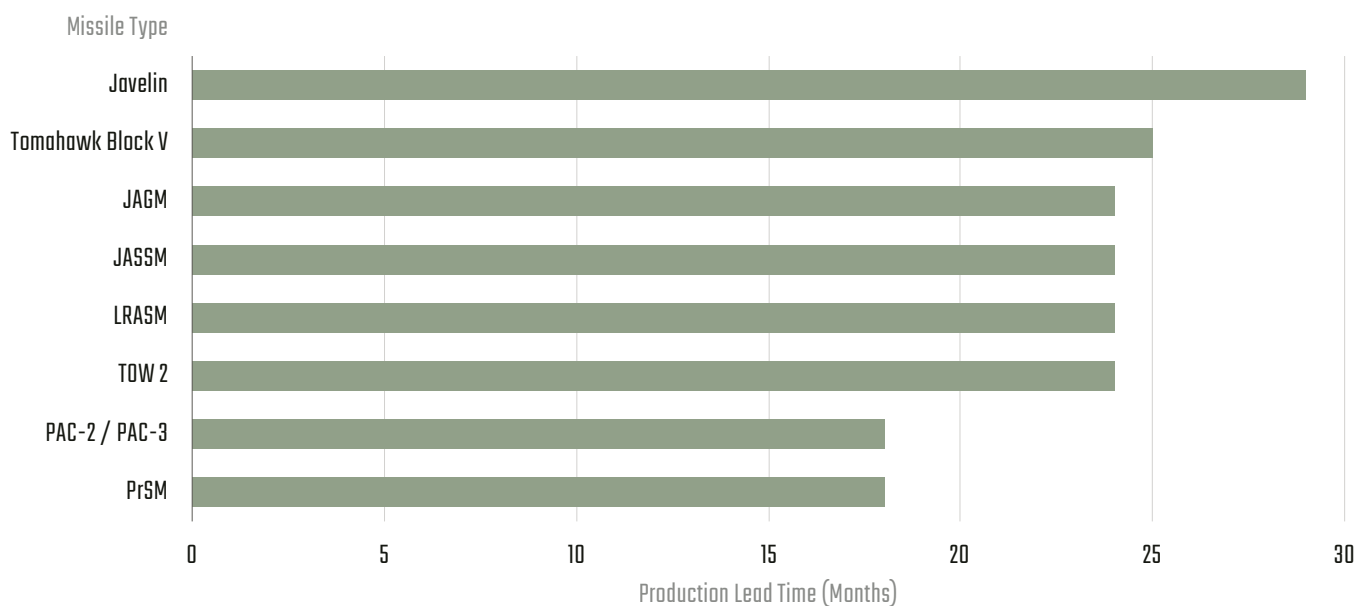
As the head of Lockheed Martin Corporation recently remarked, the changing security environment in Europe and the Indo-Pacific has raised questions about the state of the defense industrial base and the timelines involved in fixing key problems:

The value of deterrence has never been greater really at this point now. And that shift happened over literally three or four months. What that requires is the Department of Defense to shift gears, okay? And I can tell you the clutch isn’t engaged yet. And the clutch engaged means there are contracts in place. There’s a demand signal out there that’s clear. There’s funding appropriated by the U.S. Congress in the case of the United States. . . . To get the clutch to engage is going to take *two to three years*. And that’s for our allies as well because they not only have to go through their own processes internally. They then have to go through generally the Foreign Military Sales process.⁵⁸

Fourth, inflation has increased the costs and risks for defense companies and suppliers, especially for firm-fixed-price contracts signed several years ago. The inflation rate in 2022 was over 7 percent, which impacts multiyear commitments by making it unprofitable to produce the

FIGURE 4 Selected Munitions Production Timelines

SOURCE U.S. Department of Defense data from “DoD Budget Request,” Under Secretary of Defense (Comptroller), <https://comptroller.defense.gov/Budget-Materials/>; and author interviews with multiple individuals in the U.S. government and defense industry.



promised number of weapons systems.⁵⁹ After all, parts of the U.S. defense industry are already struggling. Shipyards, for example, are battling to retain workers, including welders.⁶⁰

There are some trade-offs that need to be considered. One is the extra cost of excess inventory if the U.S. government buys munitions at higher rates. While the costs for missile sustainment are likely lower than other platforms, these costs could rise with unused excess inventory based on the need for expanded storage facilities and increased spending on maintenance to make sure munitions are ready to be used. There is also a trade-off between capacity and advanced capability, such as between procuring existing munitions and developing more advanced munitions such as hypersonic capabilities. For example, should the DoD restart production of old Stingers in the short term, wait and buy inventory of a new capability, or try to do both? In some cases, such as Stingers, it likely does *not* make sense to wait for new capabilities that could take between five to seven years to produce and would undermine deterrence and warfighting. In some of these cases, it may make more sense to restart production either in the United States or overseas in Europe, Asia, or other locations through licensed manufacturing or co-production arrangements.

These trade-offs are important to think through on a case-by-case basis. But the reality is that the timelines for a conflict—and consequently for credible deterrence—are shrinking in an increasingly competitive international security environment. The defense industrial base—including the munitions industrial base—is struggling to replenish some of its stockpiles and is unable to meet wartime needs.

The reality is that the timelines for a conflict—and consequently for credible deterrence—are shrinking in an increasingly competitive international security environment.



Department Of State



CHAPTER 04

FOREIGN MILITARY SALES AND OTHER PROGRAMS AND PROCEDURES

FMS can be useful for the U.S. defense industrial base, but foreign sales take too long—particularly for key allies and partners. The FMS program is a form of security assistance in which the United States can sell defense articles and services to foreign countries. The U.S. Department of State determines which countries will have programs, the DoD executes the program, and Congress ultimately approves all foreign sales.⁶¹ Foreign sales have several benefits.

First, U.S. arms exports to allies and partners help support the U.S. defense industrial base. FMS orders can help establish predictable, efficient production rates, as well as increase economies of scale and reduce production costs. Foreign sales defray the cost of weapons systems to the United States and keeps production lines warm.

Second, foreign sales can reinforce U.S. allies and partners with U.S.-made weapons systems or parts. Foreign sales allow allies and partners to deter and fight so that the United States does not have to take action alone—or even to fight directly *at all* in some cases, as in Ukraine. Foreign sales can also improve interoperability between the United States and its allies and partners by providing the same types of munitions and systems.

Third, arms exports can prevent the sale of adversary systems, such as those of Russia and China, to potential markets. Growing competition with nations such as China and Russia, which sometimes develop advanced weaponry at lower cost than the United States, has threatened to

offset U.S. competitive advantage in the race to support allies and partners around the world.⁶²

Currently, however, the U.S. FMS system is not optimal for today's competitive environment—an environment where such countries as China are building significant military capabilities and increasingly looking to sell them overseas.⁶³ FMS is risk-averse, inefficient, and sluggish—a particular concern with key allies and partners that need to play a critical role in deterrence and warfighting against countries such as China. In one case, the decision to sell a specific weapons system to Taiwan through FMS, rather than a direct commercial sale, added two years to the delivery date—on top of a two-year production timeline—for a total of four years.⁶⁴ This is a significant and problematic difference given the ongoing tensions in the Taiwan Strait.

Concerns about selling a piece of sensitive technology can slow a sale for years. Officials can scrutinize a country's military to see if it has competent troops to operate the equipment and safeguards to keep it secure. That slow pace can leave some countries unsure if the United States really wants them as partners, and it risks pushing them to other countries to buy weapons systems and technology. But the United States must deepen its relationships in a global competition with China that is often measured by who can sell the best, most sophisticated military gear the quickest, and at the cheapest price.⁶⁵

A related issue is ITAR, the U.S. regulation that controls the manufacture, sale, and distribution of defense- and space-related articles and services.⁶⁶ But in the current environment, the ITAR process is currently too slow for sharing defense-related technical data with key allies and partners—even ones such as Australia and the United Kingdom. The ITAR process, with all of the paperwork, can take 12 to 18 months.⁶⁷ In trying to prevent military technology from falling into the hands of adversaries, the United States has put in place a regulatory regime that is too sluggish to work with critical frontline countries.⁶⁸

There are other procedures, such as the Truth in Negotiations Act (TINA), that are important to ensure that the DoD purchases supplies and services from responsible sources at fair and reasonable prices.⁶⁹ But the process can be inefficient and slow. The burden of providing a TINA-compliant proposal can extend the contracting period by at least six months.⁷⁰


The U.S. FMS system is not optimal for today's competitive environment—an environment where such countries as China are building significant military capabilities and increasingly looking to sell them overseas.

FMS, ITAR, and other programs and procedures are important to protect sensitive U.S. technology and ensure fairness. But they need to be nimbler in the current security environment. As demonstrated by AUKUS—the security pact between Australia, the United Kingdom, and the United States to cooperate on sensitive technologies, including nuclear-powered submarines—there is an urgent need to find ways to cooperate more efficiently and effectively between key allies and partners.

CHAPTER 05

GETTING AHEAD OF THE PROBLEM





A hole in the wall seen next to a clock and a calendar in Dmytrivka, Kyiv region, Ukraine.

SOURCE Alexey Furman/Getty Images

None of these challenges have quick or easy solutions. But the clock is ticking. The United States needs to be ready *before* a conflict starts, in part to maximize deterrence.

The most significant demand on the defense industrial base in a major war would likely be from munitions expenditures and the wear and tear of weapons systems and equipment. This makes it important now for the DoD to assess the wartime demands on a limited set of weapons systems and munitions, as well as to establish a more certain production future for weapons manufacturing. The broad goal should be to support the production capacity required to enable the United States and its allies and partners to deter and, if deterrence fails, fight and win at least one major theater war—if not two. “Just in time” and lean manufacturing operations must be balanced with carrying added capacity to enable a surge in case of a war. Added capacity is also important to deter adversaries, such as China, and credibly demonstrate that the United States and its allies and partners have the capability to conduct a sustained military campaign if necessary. Greater industrial capacity would also support the DoD’s efforts to provide additional capacity to European and Indo-Pacific allies and partners.

The DoD, in coordination with Congress, should develop a “break glass” plan *now* that involves taking steps in an emergency wartime situation to streamline production, acquisitions, replenishment, FMS, ITAR, and other policies and procedures. The United States cannot afford to develop this plan after a war has started. More specifically, several

None of these challenges have quick or easy solutions. But the clock is ticking. The United States needs to be ready *before* a conflict starts, in part to maximize deterrence.



steps should be considered to build a more resilient defense industrial base. A sense of urgency is critical.

Reassess total munition requirements. Key munitions questions that should be asked—and answered—include whether service planning is aligned to the realities of high-intensity combat in one—or more than one—theater, such as Europe, the Indo-Pacific, or potentially both. This might include, for example, modeling the expenditure rates of critical guided munitions among land, naval, and air forces in a major conflict at various levels of intensity, including how long it would take to restart production of critical guided munitions or to increase production. Instead of asking industry their capacity to produce specific munitions or weapons systems, a better question may be asking what the DoD needs, based on operational plans (OPLANS) and wartime scenarios and analyses.

Congress could be helpful in holding hearings, as well as requiring the DoD and independent entities to conduct a classified study to assess how many days it would take before the U.S. military exhausted its stockpiles of key munitions in one or more major wars. The study should include supplies to allies and partners since their war plans often involve using U.S. stockpiles. The 2023 National Defense Authorization Act took some useful steps to improve the DoD's capability and capacity for munitions production and stockpiling—including through reports to Congress—though Congress will need to hold the DoD's feet to the fire over the next several years.⁷¹

Reassess replenishment requirements. Important questions need to be asked—and answered: What is the

defense industrial base's ability to replenish critical weapons inventories? What is the status of missile and munition inventories, supply chains, and the U.S. ability to replenish those inventories if needed? Similar to reassessing total munition requirements, Congress could be useful in holding hearings, as well as requiring the DoD to conduct a classified study of requirements to replenish critical weapons inventories in a major war.

In addition, Congress and the DoD should consider ways to shorten the timelines for reprogramming requests—which involve a change in the application of funds—for munitions and other weapons systems, which the United States did during the wars in Afghanistan and Iraq.⁷²

Create a strategic munitions reserve. Buy one or two lots of long-lead subcomponents—such as metals, energetics, and electronics—for critical munitions to reduce the 12 to 24 months of lead time in times of crisis. Since production timelines are so long, it would be helpful to consider a strategic munitions reserve. Various authorities, such as the Defense Production Act, exist to facilitate strategic stockpiling and improve response times in cases of urgent need. The authorities outlined in the Defense Production Act can assist in increasing the supply of critical and strategic materials for use by the industrial base.⁷³

Determine a sustainable munitions procurement plan to meet current and future requirements. There is a growing need to focus on investments in specific weapons systems—such as strike, air defense, and missile defense—to deter and fight major powers to maximize rates. Munitions needs to be a priority, and they need to be protected in whatever processes the military services use to set priorities. The good news is that there is significant production capacity now for some types of weapons programs, such as the medium-range AMRAAM, SM-6, JASSM,

JASSM-ER, Advanced Anti-Radiation Guided Missile (AARGM), LRASM, GMLRS, ATACMS, AIM-9X Sidewinder short-range air-to-air missile, TLAM, and Stormbreaker air-launched precision-guided glide bomb. Congress could also, for example, make the undersecretary of defense for acquisition and sustainment responsible for weapons stockpile sizes and submit an annual classified report to Congress about the size of the U.S. stockpile and its sufficiency for expected contingencies.

The U.S. military services should also streamline guidelines and methods for contracting precision-guided munitions by tailoring them to weapons procurement. Many of the data and compliance requirements for DoD procurements for ships and aircraft are being levied on precision-guided munitions, even though precision weapons have little to no sustainment costs and are expendable. The DoD should also examine the viability of prudent wavers to TINA to speed up the contracting process and jumpstart production.

Broaden acquisition approaches and take advantage of flexibility in the contracts process.

It is important to buy missiles and munitions smarter to take advantage of scale and market power, including using tools such as advanced procurement, multiyear procurement, and economic order quantity processes. These tools have been limited to large programs such as ships and aircraft, but they could help with missiles and munitions. This should include signing multiyear contracts for munitions that maximize production rates. As Undersecretary of Defense for Acquisition and Sustainment William LaPlante acknowledged:

We buy munitions and many of these things in a single year. We don't do multiyear contracts. We do multi-year contracts for ships, we do it for airplanes, [but] we don't do it for these

other munitions. We need to do it because that will stabilize the supply chain. That'll send a signal to industry to say they're in it for the long haul, and we can make the commitment.⁷⁴

Invest in sub-tiers. The DoD needs to focus on building the capacity of sub-tier companies, particularly first tiers, to surge with targeted investments. Modest funding would significantly increase rates. Tooling and test equipment requirements at major defense primes vary by program. In most cases, these are investments that install in factories 18 to 24 months out, so investment is needed now to ramp up 24 months later. Enduring investments also support future surge requirements. These steps could potentially be accomplished by considering updating and expanding the authorities of the Defense Production Act to provide additional funding for longer lead times, expand and modernize production lines, and maximize efficiency.

Streamline FMS and ITAR for key allies and partners.

The FMS system badly needs to be reformed. FMS should deliver capability to key allies and partners as quickly as possible, though the United States still needs to keep sufficient stocks for its own use in a war. There is a growing need to speed up sales of U.S. arms to specific foreign allies—especially in Europe and the Indo-Pacific—in an effort to better compete with China and Russia and refill the arsenals of friendly nations that have given military aid to Ukraine.

The same is true with ITAR, which should be more efficient for key allies and partners. For example, what if there were approvals for FMS and ITAR for specific munitions or defense articles over a specific period of time for certain allies and partners, which would create an easier pathway for mutually beneficial sales? Congressional oversight would be important. Another idea might be to develop a program where older weapons that exit the U.S. inventory—such as Harpoon anti-ship missiles—would be given to certain allies and partners by prearrangement. They would know to plan for it on a schedule, and it could create a better flow for industry.

Create more co-production facilities and look for opportunities for “ally-shoring.” Co-production facilities can have multiple benefits, including strengthening allies and partners, increasing economies of scale, and supporting the U.S. industrial base. There have been several recent

co-production examples worth exploring in more detail, including HIMARS with Poland, PrSM with Australia, Naval Strike Missile with Norway, and SM-6 components and Tomahawks for Japan and Australia. These are examples of what has been called “ally-shoring”—supporting economic partnerships with key allies and partners.⁷⁵ In addition, the DoD should assess the pros and cons of creating multiple production lines for key weapons systems and munitions.⁷⁶



The good news is that there appears to be a great awakening in some areas of the Pentagon and Congress about challenges with the U.S. defense industrial base and the lack of preparedness for the wartime environment that now exists. The Pentagon recently created a task force of senior officials to examine long-standing inefficiencies in U.S. sales of weapons to foreign countries. The team is looking at ways for the DoD to streamline parts of the program, with the aim of putting U.S. weapons systems more quickly into the hands of partners and allies.⁷⁷ There is also a growing recognition of acquisition process challenges that limit outcomes.⁷⁸

These steps are helpful. But there is still more talk than action at lower levels of the DoD and the military services. The ongoing war in Ukraine and escalating tension with China—including in the Taiwan Strait—highlight that the United States is no longer in a peacetime environment. In 2022, President Biden indicated that the United States would support the use of force *now* to defend Taiwan if it were attacked by China, though much would ultimately depend on the context of a crisis.⁷⁹ A failure to make adequate changes today would fall into the category of what U.S. defense analyst Frank Hoffman called a “pink flamingo,” which he defined as a “predictable event that is ignored due to cognitive biases of a senior leader or a group of leaders trapped by powerful institutional forces.”⁸⁰

In his history of U.S. defense production during World War II, titled *Freedom’s Forge*, Arthur Herman documents the critical role of the U.S. defense industry in defeating Germany and Japan.⁸¹ But a revitalization of the defense industrial base did not happen overnight for the United States or its allies.⁸² As the stresses to the defense industrial base already highlight, it is time to prepare for the era of competition that now exists.

The ongoing war in Ukraine and escalating tension with China—including in the Taiwan Strait—highlight that the United States is no longer in a peacetime environment.



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APPENDIX

EQUIPMENT COMMITTED TO UKRAINE AND REPLACEMENT CONTRACT(S) ISSUES

(Through January 6, 2023)

EQUIPMENT	QUANTITY COMMITTED	REPLACEMENT CONTRACT(S) ISSUED
Stinger anti-aircraft systems (FIM-92 Stinger)	Over 1,600	Yes
Javelin anti-armor systems	Over 8,500	Yes
Other anti-armor systems	Over 48,000	No
Switchblade tactical unmanned aerial systems	Over 700	Yes
155 mm howitzers	160	Yes
155 mm artillery rounds	1,074,000	Yes
Precision-guided 155 mm artillery rounds	5,200	Yes
155 mm rounds of Remote Anti-Armor Mine (RAAM) systems	10,200	No
125 mm tank ammunition rounds	100,000	No
152 mm artillery rounds	45,000	No
122 mm artillery rounds	20,000	No
122 mm GRAD rockets	50,000	No
105 mm howitzers	72	No
105 mm artillery rounds	275,000	No
Tactical vehicles to tow weapons	276	No
Tactical vehicles to recover equipment	22	No
Ammunition support vehicles	18	No
High Mobility Artillery Rocket Systems (HIMARS)	38	Yes
120 mm mortar systems	30	No
120 mm mortar rounds	155,000	No
82 mm mortar systems	10	No
60 mm mortar systems	10	No

Tube-Launched, Optically-Tracked, Wire-Guided (TOW) missiles	2,000	No
25 mm ammunition	250,000	No
Command post vehicles	4	No
Patriot air defense battery and munitions	1	No
National Advanced Surface-to-Air Missile Systems (NASAMS), including AMRAAM and AIM-9X	8	Yes
Missiles for HAWK air defense systems	Unspecified	No
RIM-7 missiles for air defense	Unspecified	No
Avenger air defense systems	4	No
High-speed Anti-radiation Missiles (HARMs)	Unspecified	No
Precision aerial munitions	Unspecified	No
Zuni aircraft rockets	4,000	No
Mi-17 helicopters	20	No
T-72B tanks	45	No
Bradley infantry fighting vehicles	50	No
High Mobility Multipurpose Wheeled Vehicles (HMMWVs)	Over 1,300	No
Light tactical vehicles	Over 100	No
Trucks to transport heavy equipment	44	No
Trailers to transport heavy equipment	88	No
M113 armored personnel carriers	300	No
M1117 armored security vehicles	250	No
MaxxPro Mine Resistant Ambush Protected (MRAP) vehicles	527	No
Armored utility trucks	6	No
Mine clearing equipment and systems	Unspecified	No
Grenade launchers and small arms	Over 13,000	No
Rounds of small arms ammunition	Over 108,000,000	No
Sets of body armor and helmets	Over 75,000	Yes
Phoenix Ghost tactical unmanned aerial systems	Approximately 1,800	No

Laser-guided rocket systems	Unspecified	No
Puma unmanned aerial systems	Unspecified	No
Scan Eagle unmanned aerial systems	15	No
Radars for unmanned aerial systems	2	No
Unmanned coastal defense vessels	Unspecified	No
Counter-artillery radars	Over 50	No
Counter-mortar radars	4	No
Multi-mission radars	20	No
Counter-Unmanned Aerial Systems (C-UAS)	Unspecified	No
Counter air defense capability	Unspecified	No
Air surveillance radars	10	No
Harpoon coastal defense systems	2	No
Coastal and riverine patrol boats	58	No
M18A1 Claymore anti-personnel munitions	Unspecified	No
C-4 explosives, demolition munitions, and demolition equipment for obstacle clearing	Unspecified	No
Obstacle emplacement equipment	Unspecified	No
Tactical secure communications systems	Unspecified	No
Satellite communications antennas	4	No
SATCOM terminals and services	Unspecified	No
Night vision devices, surveillance systems, thermal imagery systems, optics, and laser rangefinders	Thousands	No
Commercial satellite imagery services	Unspecified	No
Explosive ordnance disposal equipment and protective gear	Unspecified	No
Chemical, biological, radiological, and nuclear protective equipment	Unspecified	No
Armored medical treatment vehicles	100	No
Generators	Over 350	No
Medical supplies, including first aid kits, bandages, monitors, and other equipment	Unspecified	No

Electronic jamming equipment	Unspecified	No
Field equipment, cold weather gear, and spare parts	Unspecified	No
Funding for training, maintenance, and sustainment	Unspecified	No

SOURCE “Fact Sheet on U.S. Security Assistance to Ukraine,” U.S. Department of Defense, January 6, 2023, <https://media.defense.gov/2023/Jan/06/200314218/-1/-1/1/UKRAINE-FACT-SHEET-JAN-6.PDF>; and “Ukraine Contracting Actions,” U.S. Department of Defense, December 5, 2022, <https://media.defense.gov/2022/Dec/06/2003126931/-1/-1/0/UKRAINE-CONTRACTING-ACTIONS-DEC-5.PDF>.

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