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Reviving the Arsenal of Democracy

Steps for Surging Defense Industrial Capacity

By Cynthia R. Cook

Russia's war in Ukraine has reinforced the necessity of maintaining a deep inventory of weapons. Any future operational plans assuming that a war will be short-lived may run against a capable and determined adversary willing to wage a prolonged conflict. That is what has happened in Ukraine, where Russia's plan for a quick decapitation strike and absorption of further territory was thwarted by the fierce resistance of the Ukrainian people with the support of allies and partners, led by the United States. It is now a war of attrition. The protracted nature of the war has prompted questions and reflection on the readiness of the U.S. defense industrial base, though the current conflict is not yet an exercise in industrial mobilization. To date, the robust support that the United States has provided to Ukraine has primarily come out of stockpiles, drawing the United States down to levels that have **triggered concerns** as to whether there are sufficient residual inventories for training and to execute war plans in the case of a conflict in which the United States is directly involved. It is no longer a question of whether the U.S. industrial base is prepared to rapidly surge production in the case of a **direct** conflict with a capable adversary—it is clear that it is not, and that is because the necessary investments have not yet been made to make it so.

In World War II, the United States served as the "Arsenal of Democracy"—a term President Franklin D. Roosevelt used to refer to the key industrial role U.S. industry played in the Allied war effort—but it took more than five years for the industrial base to fully gear up for the war effort. If the United States were to be directly engaged in conflict, the time it could take to surge production represents a serious vulnerability. Why is surging production so complicated, and why might it take so long?

Even before this conflict, concerns about the shallow depth of U.S. precision weapon inventories, the preferred weapons of defense planning scenarios, loomed in the Pentagon and Congress. This vulnerability is just now being elevated by policymakers. Language in the 2023 National Defense Authorization Act (NDAA) authorizes an increase in the acquisition of new munitions, for example, including with multiyear buying authorities. Reaching the programmed number may take years to finish

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at **current production rates**, so discussions are increasingly about the need to surge production levels as a solution, **and the U.S. Army is taking steps to support this**. However, years of underinvestment mean that the industrial base may not be sufficient to both refill and increase stocks while meeting demands from allies in the timeframe that can have a warfighting impact at the speed of relevance. Furthermore, the commercial defense industrial base itself faces an incentive structure that motivates a least-cost production model at the expense of capacity and delivery speed, which means that manufacturing slack has been eliminated to the extent possible. While this incentive structure is designed to ensure that the Department of Defense (DOD) can invest in as broad a range of capabilities as possible and to carefully allocate taxpayer funds, it has reduced the ability of the defense industrial base to surge.

Without a formal requirement with clear targets for higher sustained volumes—and with issued contracts—defense contractors have not risked investing in the production capacity that is now needed. This issue is pervasive across the defense manufacturing ecosystem, not just for munitions. Refilling inventories in a reasonable timeframe or preparing for surge more generally may require contractors to invest in additional capacity to allow for production to increase. It is thus worthwhile to review the steps required to boost production rates so that policymakers have an understanding of what it takes to surge and, more specifically, what types of investments are required.

The first question that must be addressed when considering surge production for any capability is whether existing factories and facilities have the necessary capacity to expand in-house production. Generally, an increase in production using existing facilities and workforce would be the most cost-effective approach, so assessing capacity is a key first step. The fixed costs of production (e.g., facilities and machine tools) may be useable for up to three shifts. If the factory is not at full capacity and has space for additional production requirements, more workers can be hired or additional shifts can be added. Recruiting and retaining workers is more challenging when unemployment rates are low and workforce participation rates are already high. In early February 2023, the **Bureau of Labor Statistics** reported that the seasonally adjusted unemployment rate is 3.4 percent. One major defense contractor reported offering $10,000 bonuses to existing workers for identifying new skilled mechanics who join the organization, and paying long-distance relocation costs for the new skilled touch labor employees.

If the factory is running three shifts at full capacity, there is the potential to increase production by using industrial engineers to look for new ways of doing the work, to speed up assembly, or to otherwise find efficiencies. The search for production efficiencies is not a new one, so one challenge is that the increasing automation and adoption of production approaches such as lean manufacturing may have already taken all significant slack and unnecessary expenses out of the system, an approach driven both by advances in industrial engineering and by government contract incentive structures that focus on reducing costs. There may still be room for improvement, particularly if the factory is able to use robots where increased automation is possible. Changing production approaches might require additional training for the workforce, along with coordinating with a union if there is a represented workforce.

Increasing capacity within an existing facility will require an increase in other inputs besides labor. Deliveries of raw materials, parts, subassemblies, and whatever components go into the goods being produced will need to increase to support the new production rate. Increasing production at final assembly sites requires an increase in the full range of inputs. If **supply chains are constrained**,

increasing production may be difficult or even impossible. For some subcontractors, their defense production may represent a small portion of their total output, and increasing the percentage of their output sent to defense contractors may not make economic sense if it harms their relations with other, more profitable customers. Aerospace is the largest market for titanium, but the metal has multiple consumer uses, including in automobiles—and there is a single **U.S. producer** of titanium sponge and **titanium castings**. Castings and forgings have been identified as a risk item by all services of the U.S. military. **Semiconductors** are used across the entire spectrum of manufacturing and have lead times of up to six months. Requirements for U.S.-sourced subcomponents, down to the material level, complicate production growth; contractors cannot just turn to the open market to look for new suppliers without a rigorous qualification process. Government regulations for defense contracting require U.S.-sourced subcomponents, generally down to the material level. Some munitions materials have such adverse environmental impact that they are not available in the United States, causing **dependence on foreign sources** and critical points of failure. Thus, investments in increasing the supply of manufacturing inputs are fundamental to a successful manufacturing surge.

In the case of munitions production, the DOD retains some manufacturing capacity in-house, such as artillery shells and chemicals that go into making explosives and propellants. In these government-owned, contractor-operated (GOCO) facilities, the commercial entity that manages the GOCO may have limits on investments in facilities and tooling that may not exist in contractor-owned and contractor-operated (COCOs) sites. The operating contracts for GOCO plants have a relatively short durations (5 to 10 years), which limits companies' assurance that they can recoup and profit from investments, if they are allowed to make them.

If additional factory space necessitating capital expenditures is required, there may be a corporate review process for approval before decisions are made. If the plan is approved, the new facility may either be built at the same site or at a different location. Building the facilities at the same site offers certain economies of scale, especially in terms of management. For example, plant management can take responsibility for the additional production space, the same human resources staff can oversee the process of recruiting, hiring, and training new employees, and new workers can get trained by existing production employees. Likewise, the quality assurance staff can oversee the quality processes for the new production lines. While additional personnel may be required in each of these functions to support the capacity increase, the institutions themselves are in place. For the facility itself, issues with the local community or federal regulatory agencies regarding permits, environmental impact assessments, and other technical challenges may have already been addressed. The local community may have longer-term relationships with, and thus greater trust, in plant management.

However, there are also downsides to collocating additional production space. If factories have already expanded their radius of recruitment because of the low local unemployment, additional workers may be difficult to find. Building in a new location also has the benefit of reducing the risk of having a single point of failure. For example, climate-related emergencies such as tornadoes and hurricanes have the potential to wreak significant damage, although factories may be hardened against all but the most unusual events. Human-caused disruptions such as terrorism or adversary attacks represent other risks. In one **historical example** of hardening against such disruptions in the 1950s, a second production for the California-built F-86 Sabre was developed in Columbus, Ohio.

If the decision is made to build in a "greenfield" site, the first step is to identify the location. Some states and localities may offer subsidies to attract new business, such as direct investments, tax rebates, and investments in roads. Some may have labor laws that are more advantageous to employers. It takes time for a company to collect and analyze this information. Some types of production also have very specific constraints, which may shape location decisions. Shipbuilding needs to occur on the coast, and appropriate land can be very scarce and subject to additional environmental constraints relating to littoral environments. The construction of nuclear-powered ships and submarines brings additional complications, which will contribute to the difficulty of any increase in submarine production to support AUKUS. Another example of such an issue is choosing the site location for factories working with energetic explosive material, as these will need to be located at a distance from population centers.

The new facility will also need to be designed, and there might be a time lag if a competition for the architect is held. Plants should be designed with industrial engineering considerations in mind, so space limitations should not constrain the manufacturing approach. Plans can be started in advance of the location decision, but there may need to be some changes based on the specific site. A variety of building permits will need to be obtained before building can commence, and there may be additional necessary permits depending on the production processes, such as those involving paint with volatile organic compounds (VOCs). Getting permits can be time-consuming and require support from counsel to work through the procedure and deal with any rejections. After the building is constructed, additional inspections by government regulators will likely be required before work can start.

Before building commences, a competition may be held for different construction companies to ensure best value and lowest costs. Once a contractor is chosen, some work may start immediately, but there may be items necessary for building construction with long lead times due to supply chain challenges. Building a facility to support construction may have specific requirements that take additional time and expertise, such as extremely level floors or advanced air filtration, along with the usual requirements, including electricity, plumbing, internet connectivity, landscaping, and fire alarms. New roads, a rail link, a runway, or other local transportation infrastructure may be necessary to facilitate the delivery of inputs into the plant and finished items to the customers.

As complicated as the above process is, the time to develop and build additional infrastructure may not be the biggest schedule constraint. For complex production processes, advanced machine tools can take years between order and delivery and may need to be sourced from overseas. This includes machines such as multi-axis metal cutting machines, lasers, and autoclaves. Particularly large machines and hard tooling can require additional support in the building foundation as well as overhead cranes to move heavy parts. Production planning and ordering machine tools does not need to wait until the building is complete.

A new site will require new plant management and whatever other on-site support functions are needed to run the factory. Manufacturing touch labor in defense production may require extensive training and specific certifications on skills such as welding, where it can take years to move from apprentice to mastery. In addition to the time necessary to recruit and hire new workers, on a greenfield location where most or all workers are new, it will take time to bring them up to speed and train them to work together as a team. Along with touch labor, other production elements such as industrial engineering, test, and quality control may need to be identified and staffed. Some individuals may be willing to move from other sites either temporarily or permanently to help start up the new location. The U.S. government will

also need to staff on-site regulatory functions such as the **Defense Contract Management Agency** and **Defense Contract Audit Agency**. This is not something that the defense contractors themselves can control or accelerate.

The same supply chain challenges associated with increasing production capacity within an existing plant also pertain to a new facility. Suppliers will also need to surge, and in turn, their subcontractors will need to surge. Even if the necessary excess manufacturing capacity is present, components or key materials may have limited sources and those sources may be shared by multiple product lines that might be surging at once. This is not something that prime contractors can control, although long-term relationships with suppliers, including training on best practices to develop flexible responses for changing demand, can help. That will not address the question of deconflicting requirements if multiple systems rely on the same subcontractor, especially where there is a single U.S. source. Which system takes priority will be a question that needs to be resolved. Furthermore, there are difficulties in bringing new suppliers into the defense industrial base ecosystem, including concerns about losing intellectual property rights and challenges due to the stringent government regulatory environment, such as cybersecurity requirements laid out in the **cybersecurity maturity model certification** guidelines.

For the supply chain, one strategy could include certain kinds of stockpiling of supplies—for example, maintaining inventories of materials like steel, that could be used in times of surge. This approach should focus on inputs that do not face the risk of obsolescence. In spite of long lead times for items like semiconductors, stockpiling is not a solution for those because of the rapid technology refresh in that sector, and stockpiles will risk being outdated and useless. For those, the government might encourage creating incentives for industry to develop preferred customer status with suppliers so that they can trigger priority access in the event of need. It should be noted that stockpiling or maintaining inventories of final products also comes with costs in both potential obsolescence as well as warehousing costs and regular maintenance.

Building capacity for any type of defense manufacturing—not just munitions—is complicated by the lack of a clear market signal. For consumer goods, companies can make predictions about the long-term viability of a product and estimate the return on investment of building additional capacity before making decisions. Defense production is different. The DOD is generally the only U.S. buyer for defense goods, and government policies often reduce or eliminate the contractor's ability to sell in the commercial market—that is, to foreign militaries. If a contractor invests its capital to increase capacity, and a surge in DOD requirements never materializes or results in signed contracts, the contractors would not be able to recoup their investments in that now excess capacity, and an increase in cost structure may impact their ability to successfully compete for future contracts. Multiyear contracts can provide additional fidelity to future demand, but the DOD needs congressional approval before issuing multiyear contracts, and Congress imposes **limits** on their use, although the 2023 NDAA authorized them for certain munitions purchases.

Thus, the hardest questions when planning for surge are who is going to pay for it, and how. The question of funding any necessary increases in capacity will need to be answered before capacity can be increased. A long-term commitment on the part of Congress and the services will be necessary for defense contractors to make these investments. In addition, the government will need to ensure that future contracts support the maintenance of excess capacity—of slack—rather than continually drive to low-cost solutions. The clear challenge here, as ever, is competing priorities. Investing in increasing the surge capacity for existing systems may reduce the government's budget for modernization investments

that will produce capabilities needed in the future fight. Finally, since most of the companies in the defense industrial base also produce for the commercial industrial base, they may not want to tie up capital by maintaining slack capacity if the incentives are insufficient.

Note that a strategy of working with allies can alleviate some of the strain on the domestic defense industry. "Ally-shoring" or "friend-shoring"—one approach that has been identified to take advantage of any existing capacity in the industrial bases of close allies—may be able to accelerate the potential for surge. Of course, this relies on whether there is slack capacity overseas, which would need to be assessed. Depending on how production is allocated, this can free up U.S. facilities for more advanced weaponry where export controls and intellectual property concerns could push production to stay in the United States while allocating existing capabilities to overseas suppliers. The key negotiating points to address will be deciding what is produced where, which country or which companies pay for necessary amendments to infrastructure, and how technology transfer considerations are handled.

The next war that the United States faces may not be one where it enjoys a distinct capability advantage, as in Operation Enduring Freedom and Operation Allied Freedom. For a long war against a more capable adversary, the United States may need to more directly draw on its industrial base, with production going directly from the factory to the front. After a year of supporting Ukraine primarily out of existing stockpiles, there are signs that political leadership recognizes the need to awaken the "Arsenal of Democracy" in continued support of Ukraine and to refill the "**empty bins**." Engaging the United States' larger manufacturing sector for a longer-term production increase will be a more significant effort. Developing an implementation approach to do so—an operational or "OPlan" for mobilization—is something that planners should work on now. The challenges of supporting Ukraine should show us that we are certainly not thinking about this too early, and hopefully not too late. If there is a future conflict, the nation will have to go to war with the industrial base that it has at the time. The World War II model of engaging the industrial base in five years may not be sufficient for a conflict with a highly capable adversary with a strong industrial base, a strategy of onshoring all the components of production, and near-monopoly power over critical subcomponents, including critical materials used in defense production across the world. ■

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