Hearing of the House Select Committee on the Chinese Communist Party

"Rebuilding the Arsenal of Democracy: The Imperative to Strengthen America's Defense Industrial Base and Workforce," December 5, 2024

Opening Statement of Christian Brose
Chief Strategy Officer, Anduril Industries

Chairman Moolenaar, Ranking Member Krishnamoorthi, Members of the Committee: It is an honor to have this opportunity to appear before you today on this critically important topic.

America's defense industrial base, which has helped to deter war and maintain peace for decades, has failed to keep pace and adapt with the times. It is being left behind by evolving great power threats, technological innovations in areas such as low-cost robotics and artificial intelligence, and a commercial manufacturing revolution that is enabling the hyper-scale production of everything from self-driving cars to reusable rockets to intelligent devices of all kinds. America and our allies increasingly lack the industrial capacity to deter — and, if necessary, fight and win — a great power conflict.

This problem has been long in the making. For decades, U.S. and allied military power has been defined by ever-smaller numbers of exquisite, expensive platforms and weapons that are slow, difficult, and costly to manufacture. Our stockpile of critical munitions has taken years to produce and would take just as long to replace. And yet, years of war games—including those overseen by this Committee—suggest the U.S. military would run out of these weapons in less than one week of a war with China. This is not hard to believe after Ukraine expended a decade's worth of U.S.-produced tactical weapons in just the initial months of combat with Russia.

At the same time, the survivability and enduring relevance of legacy military systems are being called into question as never before by the proliferation of AI-enabled weapons, autonomous vehicles, ubiquitous sensors, modern software, and other advanced capabilities that are lower cost and mass producible. This is not a distant concern. It is visible on battlefields in Nagorno-Karabakh, Iraq and Syria, Israel and Gaza, and Ukraine. The future of warfare is already here.

A great power conflict would be a war of production, attrition, and regeneration at scales that are nearly unfathomable to our defense industrial base. If such a conflict were to occur, we may be ready for day one, but we are utterly unprepared for day 30, let alone day 300. America and our allies need to rebuild the arsenal of democracy, and that is an achievable goal, but only if we adopt a fundamentally new approach to how we define, design, and produce military power.

Deterrence depends on an industrial base that can produce orders of magnitude more weapons and military platforms. This is not possible on a relevant timeline with our traditional defense systems and their equally traditional means of production, but it is eminently achievable with new classes of autonomous vehicles and weapons — not just small tactical systems, but larger, longer-range capabilities that can enhance our ability to project military force against great powers. The United States and our allies and partners have the technology, resources, human capital, and new manufacturing expertise to mass produce these new kinds of autonomous military systems and launch a new golden age of defense production.

This is exactly what Anduril is doing. We are moving out rapidly and spending our own money, as we have consistently done before, based on our own convictions and the clear intent of our government partners, to build new defense industrial base. We have made major investments to scale our production capacity for launched effects in Georgia, rocket motors in Mississippi, and robotic undersea vehicles in Rhode Island and Sydney, Australia. These investments are providing Anduril with significant manufacturing capacity across a range of products. But we see the need to go even further. We must move from large-scale to hyper-scale production.

The Problem of Defense Production

The challenges plaguing our defense industrial base have taken decades to materialize, and they stem from how U.S. and allied governments have defined their requirements for military power. With the end of the Cold War, it appeared that the era of great power competition was over, and that no global threat existed to our collective military primacy. We could not imagine losing large numbers of weapons and military platforms in combat, so we believed we could afford to build militaries that were effectively irreplaceable — forces composed of smaller and smaller numbers of expensive, exquisite systems that would be so stealthy, so survivable, so technologically superior that they would never need to be mass manufactured.

The result is that our current weapons and military platforms are defined by exquisiteness. They are exquisite by design, produced in such small numbers and modernized so rarely that government feels compelled to add every conceivable requirement to them, lest they miss a generational chance to do so. They are time-consuming to develop, often taking up to a decade or more of painstaking effort and small fortunes of R&D funding that are borne nearly exclusively not by the corporations that build them, but by taxpayers. They are difficult to produce and nearly impossible to produce quickly or at large scale because their manufacturing requires highly specialized and increasingly scarce labor, rare materials, secure facilities, manual production processes, customized supply chains, and other unique, non-scalable elements. They are also difficult to the point of impossible to change or update quickly with new technologies, which only makes manufacturing harder, because weapons are filled with obsolete components that fewer companies are able, or even willing, to build.

This does not happen by accident. Though rarely stated, exquisiteness in traditional military systems is actually encouraged and rewarded. Government has long assumed that more exquisite materials, components, and manufacturing processes are the only way to meet the military's unique requirements for durability, security, and effectiveness — even though it makes those products significantly more expensive and less producible. Legacy defense industry also prefers exquisite, hard-to-produce products for different reasons: They reduce competition by raising the barrier to entry, and the increased costs to manufacture these more exquisite products simply get charged to the government on cost-plus contracts. Government then makes all of these problems worse through slow, onerous verification, certification, and testing burdens.

Such exquisite, costly, and slow manufacturing processes do not lend themselves to large volumes of output. In Fiscal Year 2023, for example, the United States only planned to produce one or two submarines, several warships, 22 tanks, and a few dozen stealth fighter jets. Annual full-rate production of advanced systems such as intelligence satellites or long-range bombers can each be counted on one hand. As a result, the U.S. military is literally shrinking. Each year we are retiring ships, combat aircraft, and other major platforms at a faster rate than the industrial base is capable of replacing them.

The story is no better when it comes to weapons, especially the critical munitions that would be required to deter or prevail in a great power war. In the Fiscal Year 2024 budget request, for example, the United States only plans to procure 118 Long-Range Anti-Ship Missiles (LRASM), 39 Standard Missile 3s, 125 Standard Missile 6s, 34 Tomahawk cruise missiles, and 550 Joint Air-to-Surface Standoff Missiles - Extended Range (JASSM-ER). Most of these weapons cost several million dollars apiece, and the capacity to scale production does not exist. It is not hard to imagine how the United States would run out of these and other critical munitions in a matter of days in a war against China and then struggle to replace them on a relevant timeline. Even the less taxing burden of rearming Ukraine is proving unbearable for our defense industrial base.

The deeper problem is that this legacy approach to defense production does not scale. During World War II, the Ford assembly lines at Willow Run could be repurposed to produce B-24 bombers because those aircraft were more similar than dissimilar to commercial products. The Ford plant in Detroit today could never produce the B-21 bomber or other advanced military platforms and weapons. The designs, materials, components, labor forces, supply chains, and manufacturing processes are more exquisite and harder to replicate in almost every way than earlier generations of the same systems. Even extraordinary commitments of national will and resources, similar to World War II or the late Cold War, would not result in rapid and significant increases in defenses production. Indeed, when Ukrainian soldiers depleted the U.S. inventory of Stinger missiles in just several months of fighting, it was estimated that new systems would not reach the battlefield for two to three years, and even that required bringing workers out of retirement. No one else was able to produce them.

Our reliance upon the military equivalent of luxury goods was more defensible in a world of U.S. primacy and no great power threats to it. But that world is gone. The Chinese Communist Party has emerged as a strategic rival, and it is embarked upon an unprecedented military buildup that is specifically designed to achieve what we have long believed to be impossible: to attrit the centerpieces of U.S. military power and force us to reconstitute our effectively irreplaceable weapon systems.

China does not really have that problem. Its growing arsenal of advanced weapon systems is undoubtedly defined by its own high degrees of complexity, but China's military expansion is being powered by a domestic manufacturing engine that is outproducing U.S. industry in everything from warships and combat aircraft to missiles and drones. This did not happen overnight either. It was the product of decades of systematic U.S. de-industrialization and Chinese hyper-industrialization — itself a consequence of long-standing U.S. policy toward Beijing that aspired to forge a symbiotic bilateral relationship with America as buyer and China as builder. The result, however, is a colossal disparity in manufacturing capacity.

Take just one example: It is estimated that China possesses more than two hundred times the shipbuilding capacity of the United States. It accounts for close to half of the entire world's ship production, while the United States makes up less than one tenth of one percent. A similar story could be told across every other segment of military production.

The United States and our allies still need exquisite military systems, but they alone are insufficient. Our current defense industrial base simply cannot build enough of these platforms and weapons to win a conventional arms race against China. That would require massive amounts of additional time, money, and specialized labor — none of which we have. We need a different approach to generating military power, and there are good reasons to believe that is now possible.

A Manufacturing Renaissance

In 2013, Tesla's production goals had begun to amuse Wall Street. To justify the company's $120 share price, equity analysts at Bank of America and Merrill Lynch believed that Tesla would need to sell 321,000 cars in 2020 — more than fifteen times as many as the company projected for 2013. This meteoric increase, the analysts wrote, represented "300,000 reasons" to short Tesla stock. They noted that Tesla's planned rate of production growth was historically unprecedented in the automotive industry. Thus it was believed to be impossible. Even as the company scaled, the former Vice Chairman of General Motors, Bob Lutz, predicted in 2017 that "Tesla is going out of business." He gave the company two years to live.

By 2020, not only was Tesla still alive; it had given Wall Street analysts 500,000 reasons to eat their words. Despite a global pandemic that shut down large parts of the world economy, Tesla produced 50 percent more cars than the original target that Bank of America had considered so preposterous. This represented a 23-fold increase in the company's output of vehicles in only seven years. What the critics failed to understand was that the metrics of the automotive industry did not apply to Tesla, because it was not designing and building cars in the same way that its competitors did. Tesla was pioneering, in the words of one Toyota executive, "a whole different manufacturing philosophy."

What were the hallmarks of this new approach? In short, Tesla used software to revolutionize hardware. It broke with the traditional automotive industry practice of treating the vehicle's operating software as a secondary concern — a practice that Ford CEO Jim Farley described in 2023. '[I]t's so difficult for legacy car companies to get software right," he explained:

> We farmed out all the modules that control the vehicles to our suppliers because we could bid them against each other. So Bosch would do the body control module, someone else would do the seat control module, someone else could do the engine control module.… The problem is, the software is all written by 150 different companies, and they don't talk to each other.… And we can't even understand it all. So that's why at Ford we've decided in the second-generation product to completely insource the electric architecture. And to do that, you need to write all the software yourself. But just remember, car companies haven't written software like this. Ever.

Well, not all car companies. This is exactly what Tesla did more than a decade earlier: It treated the vehicle's software, not the vehicle itself, as the actual platform and built that software on its own as one integrated piece of technology.

Tesla is not unique in this way. This is how Apple revolutionized mobile devices and other consumer electronics. It is how Nvidia built a new generation of supercomputers. It is how SpaceX pioneered reusable space launch vehicles and built and launched more satellites in several years than all of humanity had in all of history. These and other leading commercial companies are achieving what many thought impossible because they are, first and foremost, software companies, and it is software that enables them to design, develop, and manufacture their hardware products in entirely new and different ways.

With Tesla, its software-first approach gives the company greater control over its hardware architecture, which it has used not only to build a fully electric vehicle, but also to do more mundane but equally important things. For example, Tesla is able to simplify its design by consistently reducing the vehicle's overall number of parts, moving to fewer numbers of software-controlled components while eliminating other hardware modules altogether.[29] Its open software architecture also enables Tesla to replace vehicle subsystems faster and easier with cheaper, commercially available alternatives that possess more robust supply chains. By prioritizing software, the company can iteratively redesign its hardware at every level at speeds that were unheard of in the automotive industry. Making it easier, faster, and less risky to change the product in this way removed massive legacy drivers of cost and schedule and instead made the product radically cheaper to produce.

As a result, Tesla has been able to move rapidly into large-scale production and then iterate nonstop on every aspect of the vehicle as if it were still in development. Indeed, even as Tesla was scaling manufacturing of its Model S, it was introducing dozens of engineering changes each week into live production lines. Tesla is now making hundreds of changes each month across its fleet of vehicles, all in full-rate production, in order to make them easier, faster, and cheaper to build. Just one Gigafactory produces four to five thousand vehicles a week at a cost of $37,000 apiece. That stands in stark contrast to one of the U.S. military's critical munitions, the JASSM-ER, which has an annual full-rate production volume of 525 missiles at a cost of $1.35 million each. It seems hard to believe that one weapon, as remarkable as it is, should be hundreds of times less producible and dozens of times more expensive than an electric, self-driving car that transports human life.

Not surprisingly, the commercial manufacturing renaissance has not gone unnoticed by the U.S. government and its defense industrial base, which have become enamored of new concepts such as digital engineering and advanced manufacturing. Too often, these practices are reduced to buzzwords or corporate initiatives that have become, in the words of Secretary of the Air Force Frank Kendall, "overhyped." There are certainly places where new approaches to manufacturing are being used to good effect, but if they are only used to repackage old ways of thinking and working — if they are not used, as they should be, to enable people to work differently, transform organizational culture, and fundamentally alter how products are designed and built at scale — then the whole thing misses the point. It becomes akin to electrifying the horse cavalry.

Solving the real problem of defense production requires a more radical approach. To be able to win, and thus to deter, a great power conflict, the United States and our allies require an order of magnitude more weapons and military platforms than is possible today. Our current weapons inventory is literally missing a zero. Producing at this scale on an urgent and relevant timeline (large-scale delivery in this decade) is actually impossible with traditional military systems and their equally traditional means of production. We simply do not have the necessary amounts of money, time, and specialized labor.

What is possible, however, is supplementing our current force with alternative military capabilities — the kinds of lower-cost, more autonomous, mass producible vehicles and weapons that are changing the character of warfare before our eyes. This must go beyond the smaller, tactical, shorter-range systems so familiar from Ukraine. It must also encompass much larger autonomous vehicles and weapons that have sufficient range, power, payload, and survivability to be relevant in the far more geographically expansive and operationally stressing environment of the Indo-Pacific region. Indeed, this is the only way the United States and our allies can generate a sufficient amount of military power in the limited time that remains to build it.

Software-Enabled Manufacturing

Nontraditional military systems must be produced in equally nontraditional ways. This requires new thinking as much as new technologies or new tools. The major choices that unlock large-scale production of autonomous vehicles and weapons are diametrically opposed to those of legacy defense programs, and this must happen, first and foremost, at the level of design. The fact is, the commercial manufacturing revolution will never really apply to F-35s, Destroyers, or Tomahawk missiles because inherent limitations to mass producibility were designed into them at the outset. No amount of digital engineering or other novel tools applied later in the manufacturing process will ever overcome that. It is too late. If we want totally different outcomes in the production of weapons, we must make totally different decisions in the design of weapons.

Most importantly, we must design weapons to be simple, modular, and producible, not exquisite, inflexible, and irreplaceable. This is only possible by putting software first. Our Lattice software platform enables us to design hardware products with a fully open architecture approach. This means we can make any changes necessary at any time to any level of the product — its software, its subsystems, or the overall vehicle itself — with minimal risk or regret of disturbing any other aspect of the product. The result is that we can compose autonomous vehicles and weapons quickly and easily with different sensors, computers, radios, and other mission systems and then recompose those systems all over again when threats evolve or new technologies emerge. And because Lattice delivers autonomy across every aspect of the missions that our products perform — how they sense and make sense of the operational environment, how they process and share information, and how they maneuver and collaborate to achieve missions — it enables us to make completely different hardware choices that not only maximize operational effectiveness, but also make these systems faster, easier, and cheaper to manufacture.

For example, traditional air defense systems are architected around human limitations: U.S. and allied militaries only have small numbers of specially trained air defenders who operate traditional air warning sensors, so those sensors must be more exquisite and capable of longer-range detection. This makes them much more expensive and difficult to produce in large numbers. With Lattice, we can take the opposite approach, building around machine capabilities not human limitations. Because Lattice processes, fuses, and exploits air defense sensor data autonomously, it is possible to replace more expensive, less producible sensors with lower cost, commercially available alternatives that, while less capable than their traditional counterparts, can be deployed in larger numbers and modernized more often to deliver wider and better sensor coverage to more operational users. The result is a more effective overall system that can be scaled exponentially without the traditional constraints of skyrocketing costs, production limitations, and a lack of specialized system operators.

We are taking a similar approach with our Dive family of large and extra-large autonomous undersea vehicles. We jettisoned the established practice of making the entire hull into one large pressure vessel that requires more expensive materials and manufacturing processes to protect the subsystems contained within once the vehicle is underwater. Instead, we designed a free-flooded vehicle in which only the mission computer, navigation system, and other core components are sealed within smaller, cheaper pressure vessels. This enabled us to design a vehicle around a more cost-effective, 3D-printed, composite hull that can be redesigned, reshaped, or resized at will. This, in turn, makes it possible to rapidly incorporate new mission systems of different sizes without adding significant cost or affecting any of the vehicle's other core components. The result is a lower-cost autonomous system that can be changed more easily, manufactured at larger scales, and deployed in larger numbers.

This first, software-enabled design principle leads to a second: We must design defense systems and weapons to maximize the use of readily available low-cost components with robust commercial supply chains, not expensive and specialized components that depend on narrow, defense-specific supply chains. It is simply impossible to generate the scale of production required by any other means. This is why nearly 90 percent of Anduril's products, such as multi-sensor air defense systems, autonomous military vehicles, and even fully integrated weapons, can be manufactured using commercially available components and materials.

For example, Lattice is enabling us to reimagine and redesign electromagnetic warfare (EW) systems using commercial supply chains. With our Pulsar products, we utilized commercial technology instead of the traditional approach of highly specific and tailored components. Defense-exotic components have long-lead times, are far more expensive and harder to find, they are also less capable than the commercially available subsystems that the 5G+ industry has been pouring billions of dollars into over recent years. Lattice enabled us to integrate these advanced commercial technologies, such as software-defined radios and high-power graphics processing units, and rapidly deliver an unprecedented new weapon system. And unlike legacy EW systems, Pulsar is completely reconfigurable and reprogrammable through software. New, industry-leading capabilities can be added immediately by integrating new algorithms into Lattice without making a single hardware change.

Similarly, for the Enterprise Test Vehicle we are building for the U.S. Air Force, we are not using the standard, expensive cast metal fuel tank with its more limited defense-specific supply chain. Instead, we are utilizing a cheaper vessel produced through the same commercial casting process used to make large toys — a process that many vendors can do at massive scales. We are also forgoing the exquisite composite production processes that are used to produce many missile airframes and instead are using a heated pressing process used to manufacture fiberglass bathtubs. The result, while durable enough to meet requirements, is less expensive, more producible, and has a broader and more resilient supply chain. It means that the many companies in the United States or allied countries that are capable of producing bathtubs can now be part of the supply chain to mass produce a new kind of weapon.

A third principle for mass producibility is that we must design weapons that are far less dependent upon highly specialized labor and can be manufactured instead by the largest possible workforce. This is how it used to be. The original arsenal of democracy was built by average workers, such as Rosie the Riveter, who could be employed with relative speed and ease to scale military production. Rebuilding the arsenal of democracy will not be possible if large numbers of American and allied workers are effectively excluded from building them. This means that military vehicles and weapons must be designed and redesigned to systematically eliminate highly customized or classified components, exotic or specialized materials, artisanal manufacturing processes, and other exquisite features that only reduce the pool of qualified workers who can build them. We must instead design weapons that open up automotive, consumer electronics, and other commercial workforces to become part of the defense industrial base. This further reduces the time, cost, and complexity of defense manufacturing while creating the latent surge capacity that makes it possible to ramp up weapons production in the event of a crisis.

These workforce considerations have informed our design and manufacturing approach to collaborative combat aircraft for the U.S. Air Force and other partners. From the start, we designed our autonomous fighter aircraft, Fury, with a carbon fiber rather than an aluminum airframe. We selected a well-known, commercial engine that does not require defense-specific parts, services, or handling restrictions. Instead of utilizing overly complex military landing gear, we designed a simpler version that is easier to manufacture. And we rejected complex bonding processes for the aircraft's assembly in favor of simple mechanical fasteners that are sufficient for the mission and require no specialized training or tools to employ. The resulting aircraft is designed for mass production by the broadest possible workforce. It has a small number of simple parts that can effectively be assembled like modular, store-bought furniture.

The net effect of these manufacturing-first design principles is that we can break many of the established rules of defense production. We can shift, for example, from a linear to a non-linear manufacturing process. Rather than moving sequentially from design to development to production, which only increases cost and time, we can take a prototype rapidly into large-scale production and continue to iterate on it as if we were still in development. Nor are we constrained to a linear process of changing a product one piece at a time, lest changes in one area create unintended consequences in other areas. Because these products are software-defined, we can alter any aspect of them — their software and hardware, their subsystems and the overall products themselves — simultaneously and constantly. Indeed, the faster we are able to move into large-scale production and make these iterative changes, the faster we can capture the critical insights that enable us to make these products simpler, cheaper, and easier to build — insights that are only realizable in high-rate production.

Toward Hyper-Scale Production

Anduril has been putting this software-defined approach to defense production into practice over the past several years. We have been proving it out across a range of products — from autonomous aircraft and submarines to weapons and solid rocket motors — and a growing footprint of manufacturing locations that now includes California, Mississippi, Rhode Island, Georgia, and Sydney, Australia. This fundamentally different approach to weapons design and production is a major reason why Anduril, despite our lack of "traditional" defense manufacturing experience, is being selected to perform on major defense production programs, such as the U.S. Air Force's Collaborative Combat Aircraft and the Australian Navy's Ghost Shark Extra-Large Autonomous Undersea Vehicle. Our more commercial manufacturing approach is viewed as an asset.

This, however, is only a start. We realize the need to take a much more ambitious step. We must move from large-scale production to hyper-scale production, and that requires a complete reimagining of what is possible — and what is required — in defense production. The United States and our allies must seek to build naval forces composed not of a few hundred ships but a few thousand large and extra-large surface and undersea vehicles. We must seek to build air and space forces comprising tens of thousands of autonomous aircraft and spacecraft of every different type for every different mission. We must seek to build multiple robotic ground combat vehicles for every manned vehicle that is produced. We need orders of magnitude more weapons. And we need all of this new defense production not decades from now, but in a matter of years.

This is the goal of Arsenal, our latest product. It is how we will achieve hyper-scale defense production, and when it is complete, it will be a unique capability in the defense industrial base: a software-defined manufacturing platform, embodied in a facility of around 5 million square feet, that is capable of the simultaneous full-rate production of every Anduril product.

The organizing principles of Arsenal is adaptability. Whereas many defense production facilities are purpose-built for specific programs but not easily reconfigurable to produce other types of weapon systems, Arsenal will take the opposite approach. It will provide a modular, generalizable manufacturing platform that can produce autonomous military vehicles and weapons of nearly every class, size, and operational domain — both present systems that meet present requirements, but also future systems that can meet unknown future requirements when threats and technologies inevitably evolve. This kind of adaptability is only possible because Arsenal, like every Anduril product, is hardware-enabled but software-defined.

In a superficial sense, Arsenal is a factory, but a different kind of factory. It utilizes, to the greatest extent practicable, a common set of commercial manufacturing tooling, machinery, and processes for every type of autonomous vehicle and weapon that Arsenal produces. Rather than changing our manufacturing platform to make products with more customized requirements, we will instead seek to redesign our products, consistent with mission requirements, to eliminate any features or parts that require specialized manufacturing tools and processes that deviate from the Arsenal platform. This ensures that we can quickly and easily reallocate our most critical resources — people, capital, machines, and materials — to hit new production targets, launch new products, or surge manufacturing of certain products in the event of a crisis. Indeed, to achieve hyper-scale production, Arsenal as a factory must be maximally reconfigurable with minimal time, cost, or effort.

What makes Arsenal unique, however, is the software that powers everything from the design lab to the factory floor. It is an integrated digital platform that we call the Arsenal Operating System (OS). Just as Lattice provides a common set of software services to operate autonomous systems, Arsenal OS provides an additional set of software services to design, develop, and manufacture those systems, including threat-based operational analysis, large-scale modeling and simulation, digital design and engineering, enterprise resource planning, and final assembly and verification. This represents a common digital interface for every engineer and technician building in Arsenal, which makes it that much easier for them to modify existing products, start new products, or shift from one team to another. They are largely working in the same ways. Here, too, the goal of Arsenal OS is the same as that of Lattice itself: autonomy for every mission. It enables more human beings who lack specialized skills to focus on higher-value work and perform that work better, faster, and at larger scales as a result of their collaboration with AI-enabled software and intelligent machines.

Arsenal is founded on another idea that is diametrically opposed to existing defense industry practices: Rather than geographically distributing the production of different military programs, we will seek to consolidate it. This will not include energetics production, which possess their own separate handling requirements, but it will apply, as much as possible, to the full range of autonomous vehicles and weapons that we build. While we recognize the political benefit of geographically distributing the production of multiple programs, the manufacturing benefits of bringing it "under one roof," are significant. It enables us to reallocate critical resources with a speed and flexibility that just is not possible when those resources are spread around the country or the world. That speed and flexibility is indispensable to achieving hyper-scale production.

The broader impact of Arsenal as a software-defined platform is that manufacturing becomes a product unto itself. This is essential when future threats, technologies, and weapons requirements are all rapidly changing. The manufacturing process and the factory itself must be constantly adaptable. This is how Arsenal can and will evolve over time. It will become better able to assist our engineers in rooting out complexity in the design of our products and making them faster, easier, and cheaper to produce. Different factory floor and production process configurations will be modeled and optimized to achieve ever larger scales of weapons production. All of this will open up the Arsenal platform to greater numbers of workers whose lack of specialized skills are overcome through the intuitive use of increasingly intelligent software and machines. In this way, hyper-scale production is not only the end in itself but also a process that is constantly improving and never-ending.

We are setting ambitious goals for Arsenal-1, our first hyper-scale facility. At full-rate production, it will employ more than 1,500 people, encompass up to 5 million square feet of manufacturing capacity, and be able to produce tens of thousands of autonomous military vehicles and weapons (minus the energetics) of all different kinds each year. The entire manufacturing platform will also be fully replicable. Arsenal-1 will be located in the United States, but Arsenal-2, Arsenal-3, and other future factories could be located in allied countries.

That model scales indefinitely and makes it possible to rebuild the arsenal of democracy not as a U.S. capability alone, but as the aggregation of allied production capacity.

Because we have conviction in our vision for Arsenal, we are not waiting for others to make it a reality. We are moving forward with a considerable investment — eventually reaching hundreds of millions of dollars — to bring Arsenal-1 to life. In time, we expect government partners in the United States and our democratic allies to invest alongside us to stand up future Arsenals. After all, larger amounts of resources from a larger number of partners only increases the speed and scale of production capacity. And we think the best way to rally this support is by taking the first step ourselves.

Our vision of hyper-scale defense production might seem fanciful, but it is eminently achievable. All of the raw materials and necessary conditions for success exist across the United States and our democratic allies and partners. We have all the necessary technology. We have more than enough human capital. And we have sufficient resources across government and the private sector, if we choose to use them effectively and efficiently. The biggest challenge is neither technical nor material; it is the capacity of government leaders in the United States and our allies and partners to imagine, after so many years of under-delivery by our legacy industrial base, that it is actually possible to generate exponential increases in military capability on a relevant timeline and restore a rapidly deteriorating balance of power — that it is possible, in short, to rebuild the arsenal of democracy, and once resolute in that conviction, to summon the will to make it so before it is too late.

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