Building Resilience: Mobilizing the Defense Industrial Base in an Era of Great-Power Competition

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Increasing national security concerns about China's military capabilities and mercantilist economic policies, the growth of commercial technologies like artificial intelligence and robotics, and now a global pandemic have put a spotlight on the U.S. defense industrial base. A robust, secure, and resilient defense industrial base has been an important national priority in recent years. High-level reviews, increased investments, new legislative authorities, and efforts to encourage new entrants have been undertaken to grow and strengthen this industrial base.

How are we faring? Does our industrial base have enough capability and capacity for this era of strategic competition? And how resilient would our industrial base be in response to a national emergency?

The response to the current COVID-19 pandemic has given us a partial answer to these questions. Although the public health focus is obviously different from a military threat, the tools and authorities that are available to respond to this national emergency are essentially the same. Despite the glaring weaknesses in our public health supply chain that the pandemic has exposed, and despite the initially chaotic (albeit massive) response from government agencies and companies across the country, the ability of the U.S. to mobilize its industrial base to meet national emergencies has improved significantly. There is, however, still much work to be done.

Examining how the defense industrial base has mobilized to meet crises from the 20th century to more recent efforts, including the response to COVID-19, can help us to separate fact from myth and start to identify best practices for the future.

Nature and Structure of the U.S. Defense Industrial Base

The defense industrial base is an essential element of the country's national security and can even be considered a central component of the military force structure. The industrial base develops and produces systems and provides services that enable our warfighters to protect our homeland and to deter and defeat adversaries on the ground, at sea, in the air and space, and in cyberspace.

The defense industrial base is comprised principally of private and publicly traded companies that range widely in size and composition. In general, these firms fit within three major categories:

- A small number of large companies that serve as prime contractors and integrators on major weapons systems;

- A larger number of mid-tier companies that manufacture major subsystems or provide technical services to Department of Defense (DOD) customers; and

- A very large number of small companies that manufacture spare parts or provide material serving both commercial and defense customers, serve as nontraditional start-ups developing innovative technologies, or are focused on a particular defense segment or customer set.

All told, the number of firms that contribute in some way to the U.S. industrial base likely well exceeds 100,000, according to Vice Admiral David Lewis, director of the Defense Contract Management Agency.[1] These firms all work closely with government customers to field capabilities for the national defense.

In addition to these private and publicly traded companies, there is a much smaller component of government-owned facilities that produce and service systems: the organic industrial base. These facilities include shipyards, arsenals, maintenance depots, and ammunition plants.[2] Their capabilities include the expertise to "perform deep repair, the means to provide repair parts to the shop floor, and the ability to deliver repaired systems to the time and place of the fight [that] accompanies every military ship, plane, vehicle, and weapon."[3]

The "reemergence of long-term strategic competition" with China and Russia articulated in the 2017 National Defense Strategy (NDS) has led to substantial changes in DOD investment priorities that have shaped the efforts and even the composition of the defense industrial base. The NDS further notes that "[m]aintaining the Department's technological advantage will require changes to industry culture, investment sources, and protection across the National Security Innovation Base."[4] The term "National Security Innovation Base" was introduced in the 2017 National Security Strategy to reflect the broad "network of knowledge, capabilities, and people" that "protects and enhances the American way of life."[5]

The NDS definitely reinforced the emphasis on increasing the number of commercial entrants in the defense industrial base that had begun with efforts such as the Defense Innovation Unit (DIU), self-described as a DOD organization that "strengthens our national security by accelerating the adoption of commercial technology throughout the military and growing the national security innovation base." Specifically, "[w]ith offices in Silicon Valley, Boston, Austin, and the Pentagon, DIU connects its DoD partners with leading technology companies across the country."[6] The military departments have launched similar initiatives such as AFWERX and Army Futures Command.[7] The overall thrust of these efforts has been to focus on commercial innovation because that is the nature of such key NDS technology focus areas as artificial intelligence, robotics, autonomy, and quantum computing.

Whatever its ultimate composition, the defense industrial base must have the ability to mobilize to meet the country's national security needs. This mobilization is driven by three principal components:

- **Capability.** Do we have the defense industrial capabilities we need? Are we investing in the right technologies and building the systems necessary to face both current and future national security challenges?

- **Capacity.** How much redundancy and industrial capacity are appropriate? Are we developing enough manufacturing competency to meet surge requirements in the event of protracted conflict?

- **Resilience.** How can the United States fully mobilize the capabilities and capacities of the defense industrial base to meet future contingencies? How quickly, for example, can we ramp up production lines or adjust to emerging industrial requirements in the middle of a major crisis?

All three components are crucial. None of them is fixed, of course. Any of these components can be increased or decreased through attention and resources. At the same time, however, getting the balance of capabilities and capacities right is key because it takes time to change direction. As former Secretary of Defense Donald Rumsfeld famously quipped, "You go to war with the army you have, not the army you might want or wish to have at a later time."[8]

The key outcome of this balance of capability and capacity is resilience. Resilience determines whether the defense industrial base can ultimately produce and deliver in response to a true national crisis. Let us examine how the defense industrial base has performed over time to put that balance in context.

Mobilization in the 20th Century

World War I. By the start of the 20th century, the United States had become a true industrial power. In the early 1900s, U.S. industrial capacity surpassed that of major European powers like the United Kingdom, France, and Germany, but the United States was focused solely on commercial enterprises, and there was very little defense-focused industrial capacity apart from a limited number of arsenals and shipyards.[9] As tensions in Europe grew and war approached, countries formed alliances and began to mobilize their industries to build rifles, trucks, artillery, airplanes, and other vehicles. Barbara Tuchman's riveting account of German and other European military planners' detailed mobilization plans in preparation for war in her famous work *The Guns of August* vividly depicts this mobilization.[10]

This high state of alert was certainly not present in the United States in 1914, when the Army was a very modest force of just over 127,000 soldiers and there was little appetite for war. In fact, President Woodrow Wilson won reelection in 1916 in large measure because of his slogan, "He Kept Us out of War."[11]

That changed in 1917 when the United States entered World War I. Businesses and business leaders stepped forward dramatically to help the war effort. This is illustrated most notably by the War Industries Board (WIB). The WIB was an emergency agency created and largely led by industry executives—so-called dollar-a-year men—on loan from their respective companies to help oversee war production. While private enterprise played a significant role in war mobilization, this rapid effort also included some heavy government intervention such as an "excess profits tax." In addition, the government exercised what historian Mark Wilson calls "government coercion" and assumed control of private enterprises like Smith & Wesson for periods of time to overcome labor disputes or to direct production.[12]

The results of these efforts were significant. The crash mobilization efforts ultimately succeeded in building a sufficient number of cargo ships to move all of the men and materials needed for the war, including 2 million rifles, 80,000 trucks, and 12,000 airplanes, in less than two years. Unfortunately, however, most of this equipment arrived too late. General John J. Pershing's American Expeditionary Forces, totaling almost 2 million men, used a fair number of British rifles and machine guns as well as French airplanes during the Great War. As Arthur Herman notes in his dramatic account (devoted principally to World War II mobilization), "Of the 10,000 75mm artillery pieces the War Department ordered, only 143 ever reached the front—and not one American-made tank."[13]

After the November 1918 Armistice, the United States quickly dismantled the WIB in 1919, and the industrial base returned to its prewar focus. The Great War experience, however, did significantly inform American mobilization efforts in World War II.

World War II. The United States watched during the 1930s as tensions again rose in Europe. Domestic attitudes remained hostile toward involvement in another European war, and American industrial efforts reflected that posture of neutrality. President Franklin D. Roosevelt, who had served as Assistant Secretary of the Navy during World War I, clearly

TABLE 1

Comparing Peacetime and Wartime Production During World War II

Product	Prewar Baseline Output	Wartime Peak Output	Peak/ Baseline
Synthetic rubber	3,200 long tons (1940)	922,000 long tons (1945)	288.1
Aviation gasoline	4,000 barrels/day (June 1940)	520,000 barrels/day (March 1945)	130
Merchant ships	0.3 million dw tons (1939)	18 million dw tons (1943)	60
TNT	100,000 lbs./day (June 1940)	4 million lbs./day (Dec. 1942)	40
Airframes	20.3 million lbs. (1940)	797.1 million lbs. (1944)	39.3
Magnesium	12 million lbs. (1940)	368 million lbs. (1943)	30.7
Aluminum	327 million lbs./year (1939)	2.3 billion lbs./year (late 1943)	7
Electric power	28 million kilowatts (1940)	44 million kilowatts (April 1944)	1.6
Steel	82 million net tons (1940)	96 million net tons (1945)	1.2

SOURCE: Mark R. Wilson, *Destructive Creation: American Business and the Winning of World War II* (Philadelphia: University of Pennsylvania Press, 2016), p. 79.

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recognized the domestic political constraints, but he benefited from the need of the British and French governments to buy aircraft and ships in the late 1930s to confront the growing Nazi threat.

Congress passed the $1.1 billion Fleet Expansion Act in May 1938 to address these international orders as well as increasing domestic orders for ships.[14] Although the United States continued to remain neutral after war began in Europe in September 1939, the need for increased industrial mobilization had become clear. In May 1940, General George C. Marshall, the U.S. Army Chief of Staff, convinced President Roosevelt to increase the Army's 1940 appropriation request dramatically from $24 million to $700 million.[15] These significant actions helped to create the conditions for "the great arsenal of democracy" that Roosevelt famously announced as his goal for America in a December 1940 fireside chat.[16]

This arsenal would be built by a diverse set of characters that represented an underappreciated cohort of the Greatest Generation. They included new dollar-a-year men like General Motors President Bill Knudsen, known as the "Big Dane," who resigned his position after a phone call from President Roosevelt in mid-1940 requesting that he come to Washington; industrialists such as the colorful Henry Kaiser, a high school dropout who became a production wizard; government officials such as former cotton broker and head of the Reconstruction Finance Corporation Jesse H. Jones; and even New Dealers such as the President's close adviser Harry Hopkins.[17]

Despite often being at odds with one another, these leaders achieved tremendous results in establishing industrial capacity in such areas as materials, steel, ships, tanks, and aircraft. They directed or oversaw significant government investment through the alphabet soup of government organizations created during the war such as the War Production Board, its successor Office of Production Management, the Reconstruction Finance Corporation, and many more. Success was accomplished principally through public investment to create new shipyards and manufacturing plants that were run by private companies. These

government-owned and contractor-operated (GOCO) facilities were the largest investment in manufacturing capacity during the war and became a successful business model that continues today.[18]

Most important, these GOCOs produced. As Knudsen and his successor, former Sears, Roebuck executive Don Nelson, worked with the President to establish ambitious production goals each year, the base would inevitably meet and exceed these goals. The sheer numbers and scale are breathtaking. Mark Wilson's analysis lays out the magnitude of this increase in Table 1.

This level of production simply swamped that of America's adversaries. "In 1943," notes Arthur Herman, "American war production was twice that of Germany and Japan combined."[19]

The private-sector companies that produced the output of the arsenal represented all aspects of American manufacturing. The largest government contractors were major existing businesses like Bethlehem Steel, Chrysler, General Motors, Ford, Sperry Gyroscope, and Wright Aeronautical, which expanded or modified their production lines to support the war effort.[20] Thousands of other small and mid-size companies similarly converted their operations or were formed to meet the tremendous war demand. Among the most dynamic and innovative sectors during the war was aircraft manufacturing, with such companies as Lockheed Aircraft, the Curtiss-Wright Corporation, the Glenn L. Martin Company, the Allison division of General Motors, Pratt and Whitney, Boeing, and the fledgling Grumman Aircraft in Long Island, New York, producing aircraft and engines throughout the war.[21]

Not surprisingly, though, there were at times significant challenges in this mobilization. Government seizures of companies, labor unrest, and tensions between government and industry over price controls and profit margins were also regular features during the war.[22] Numerous production efforts struggled or spectacularly failed. The B-29 superbomber, for example, was a tremendous struggle for prime contractor Boeing, government program managers, and the defense industrial base, but through the persistent efforts of all involved, the B-29 came into service and at the end of the war played a pivotal role that included dropping atomic bombs on the Japanese cities of Hiroshima and Nagasaki.[23]

The extraordinary results of the overall effort, however, speak for themselves. When the war ended, the United States was undeniably the world's principal industrial power. But the end of the war also led to rapid demobilization of the armed forces and the start of industrial "reconversion." The government disposed of many GOCOs through privatization, a trend that continued across the defense sector.[24] That, plus conflict on the Korean Peninsula and the onset of the Cold War, helped to shape the defense industrial base for the remainder of the 20th century.

Korea and the Defense Production Act. The Soviet establishment of puppet regimes in Eastern Europe in the aftermath of World War II and the North Korean invasion of the South in 1950 led Congress to enact the Defense Production Act (DPA), which was modeled on the authorities of World War II. President Harry S. Truman used the DPA principally to prioritize and direct production efforts. He continued, for example, the practice of government seizures of private companies, although this practice came to an end after the Youngstown steel strike of 1952. Concerned about the impact of the strike on the war effort, the President issued an executive order in April to force the steel mills to stay open. The Supreme Court, however, ruled that Truman's seizure of the steel industry was unconstitutional.[25]

Despite the Supreme Court ruling, the DPA took shape over time. The law gave the President broad authority to ensure the timely availability of essential domestic industrial resources to support defense requirements. Congress continued to reauthorize three of the original DPA titles, which were used regularly throughout the Cold War and in the decades following the fall of the Berlin Wall.

- Title I is focused on the distribution and allocation of goods and services. The distribution authority of Title I permits the government to prioritize contracts to meet priority government needs. The Defense Prioritization and Allocation System (DPAS), overseen by the Department of Commerce, uses this authority regularly to prioritize orders and rate contracts to meet government-mandated critical infrastructure requirements.[26]

- The allocation authority of Title I permits the government to prioritize industrial efforts to meet national defense priorities. This authority was rarely used in the aftermath of the 1952 steel strike, but it was central to the establishment of the Civil Reserve Air Fleet (CRAF). CRAF, managed by the Department of Transportation, gave the President the ability to mobilize specific aircraft for government use in the event of national emergency.[27] CRAF planning efforts focused for example, on surge requirements to deploy U.S. troops and equipment to Europe to help the North Atlantic Treaty Organization (NATO) defend Europe in the case of Soviet military aggression.

- Title III focuses on the ability to "create, maintain, protect, expand, or restore industrial base capabilities essential for national defense" through grants, loans, purchases, and purchase commitments.[28] The President delegated authority to the Department of Defense to manage this authority. Over time, Title III became focused almost exclusively on grants—principally congressional earmarks—to increase industrial capacity in areas of industrial base weakness such as complex forgings for naval propulsion shafts and the creation of a domestic production facility for beryllium.[29]

- Title VII focuses on voluntary agreements between the private sector and government to "help provide for the national defense" in times of crisis.[30] Only one voluntary agreement on the maritime industry currently exists, and it is managed by the Department of Transportation. Foreign direct investment is also covered under Title VII and is governed by the Committee on Foreign Investment in the United States (CFIUS). CFIUS is an interagency committee that, led by the Department of the Treasury, reviews foreign investment transactions for national security concerns. CFIUS was added to Title VII in 1988 through the Exon–Florio amendment to the DPA but received little public attention until the Dubai Ports transaction in 2007.[31] This transaction, which proposed the foreign purchase of six U.S. ports, led Congress to pass the Foreign Investment and National Security Act to create CFIUS in statute.[32]

Industrial Base and Industrial Policy Trends. The privatization of the defense industrial base (which President Dwight D. Eisenhower famously dubbed the military–industrial complex in his 1961 farewell address) continued during the Cold War.[33] Throughout decades of East–West confrontation, dozens of major defense contractors developed ships, aircraft, and ground vehicles for the Department of Defense.

The existential threat of nuclear war and the militarized border between NATO and Soviet bloc forces led to a consistently large U.S. defense budget—generally over 5 percent of gross domestic product—throughout the Cold War.[34] This changed dramatically after the fall of the Berlin Wall and Secretary of Defense William Perry's "Last Supper" meeting with major defense company CEOs, which sparked a significant round of industrial consolidation within the defense sector as budgets declined after the Cold War ended.[35]

Inside government, meanwhile, there was little coordinated focus on industrial policy or planning. The Office of War Mobilization, which performed this function during World

War II, was abolished immediately after the war. President Truman created a comparable entity, the Office of Defense Mobilization, during the Korean War, but President Eisenhower greatly reduced the stature of this office in favor of a market approach.[36]

Much of this was purposeful because of long-standing American bias against industrial policy. As the late Jacques Gansler noted, "[t]he U.S. economy is built on the strong assumption of the benefits of free-market operation and has long been averse to industrial planning, even in the defense sector."[37] Unlike Cold War adversaries like the Soviet Union and China, the United States did not put great stock in five-year plans to achieve industrial results. Instead, U.S. leaders believed that, much like the perceived experience during World War II, the dynamic nature of the U.S. economic system and the strength of the overall industrial base would be able to respond to any national crisis.

Mobilization in the 21st Century

As the nation moved into the second decade of the 21st century, national security officials began to rethink many of their assumptions about mobilization and the defense industrial base.

Post-9/11 Conflicts and the MRAP. The conflicts in Afghanistan and then Iraq in the wake of 9/11 spurred industrial mobilization efforts that were substantially different from those that had arisen in response to previous conflicts. During the early 2000s, most of the industrial base focused on developing capabilities to fight insurgents.

Particularly in Iraq, improvised explosive devices (IEDs) became the greatest threat to American forces. U.S. armored vehicles had been very effective in toppling the Taliban and Saddam Hussein regimes but were much less suited to protecting soldiers against IEDs. Large and small companies focused on developing systems to counter IEDs as well as additional force protection for individuals and vehicles. Overall, the defense industrial base was up to the task, developing more advanced body armor for soldiers and additional armor for vehicles. DPA Title I was even used to help prioritize the production of body armor.[38] Despite these improvements in force protection, however, deaths from IEDs continued to mount.

The Mine-Resistant, Ambush-Protected Vehicle (MRAP) ultimately became the force protection solution for American forces, but its development and deployment were not without challenges. As James Hasik points out in his forthcoming book, the foremost challenge with respect to the MRAP was getting it established as a true acquisition priority. The MRAP was a radical departure in armored vehicle design, and it competed with other priorities.

Prioritization changed with the arrival of Robert Gates as Secretary of Defense in 2007, but challenges to the industrial base were not insignificant. There were initial industrial bottlenecks for ballistic glass, axles, tires, and spare parts, but the biggest challenge was steel plate. With extremely limited domestic capacity to produce steel plate for the MRAP, DOD qualified foreign-owned and foreign sources to meet the demand. Secretary Gates also used the highest DPA Title I DPAS rating, DX, to prioritize steel plate procurement. Eventually, these challenges were overcome, and tens of thousands of MRAPs were produced and delivered to Iraq, contributing significantly to the dramatic reduction in IED casualties by 2008.[39]

Sharpening Focus on the Defense Industrial Base. The proliferation of high-tech commercial technology and the shifting of manufacturing and production to meet the demands of the global economy have had tremendous economic benefits for the United States and countries around the world, but they also have given rise to trends and practices that would be problematic in war. The limits of these approaches, which include just-in-time manufacturing and global supply chain optimization, became increasingly visible in the defense industrial base as the country entered the second decade of the new century and troop levels in the Middle East decreased.

While national security priorities and Buy America laws ensured that the vast majority of the development and production of defense

systems occurred in the United States, the production of some critical subcomponents and materials migrated overseas. DOD's annual *Industrial Capabilities* reports to Congress identified many of these weaknesses in the industrial base.[40] They noted, for example, that the production of microelectronics and materials such as rare earth elements as well as specialty chemicals and energetics used in explosives were increasingly produced only outside of the United States—in some cases, almost exclusively in China. These components and materials are used overwhelmingly for commercial purposes in electronics such as computers and smartphones, but they also are essential components in critical advanced defense systems such as radars and precision-guided munitions (PGMs).

The short-lived 2010 Chinese embargo of rare earth elements following the Japanese seizure of a Chinese fishing vessel brought attention to the dominant position that China had achieved, largely through state industrial policy, in rare earth mining and processing. Although the crisis quickly passed, the lack of U.S. domestic rare earth capacity and consequent dependence on a foreign source of supply remained.[41]

DOD's focus on the industrial base sharpened during this period as a result. The Office of Industrial Affairs, which had been demoted in stature in the early 2000s, was elevated and eventually strengthened further in 2013 with the creation of the Office of Manufacturing and Industrial Base Policy (MIBP). In addition to the traditional focus on industrial base assessment, anti-trust reviews of defense-related mergers and acquisitions, and DPA Title III, the responsibility for CFIUS was transferred to MIBP. This reorganization and a direct-report relationship to the Under Secretary of Defense for Acquisition, Technology, and Logistics gave DOD a stronger focal point for industrial base analysis and mitigation efforts across the department.

This sharpened focus played a significant role in addressing the changing nature of foreign direct investment as the country of origin in CFIUS transactions began to shift substantially after 2010. From 2007–2009, for example, acquisitions originating from companies in the United Kingdom, Canada, France, Australia, and Israel—traditional U.S. allies—accounted for 57 percent of 358 covered transactions. Transactions originating from Chinese firms were less than 4 percent of the total. In less than a decade, those ratios shifted dramatically. From 2016–2018, transactions originating from China were the largest proportion of cases filed: 26.5 percent. Moreover, the nature of the Chinese transactions drew increased scrutiny because the vast majority of these proposed acquisitions (84 percent) were focused on the manufacturing, finance, information, and services sectors.[42]

This shift drew significant bipartisan congressional and executive branch concern about the impact of increased levels of Chinese ownership or control in such critical sectors of the industrial base as microelectronics. On August 13, 2018, the President signed into law the National Defense Authorization Act (NDAA) for Fiscal Year 2019, which included the Foreign Investment Risk Review Modernization Act of 2018 (FIRRMA).[43] FIRRMA was the most significant reform of CFIUS since the Foreign Investment and National Security Act (FINSA) of 2007 and helped to modernize national security reviews of financial transactions by "expand[ing] the scope and jurisdiction of CFIUS," refining CFIUS procedures, and requiring "actions by CFIUS to address national security risks related to mitigation agreements."[44]

2017–2018 White House Defense Industrial Base Review. The galvanizing point for sustained action in the defense industrial base was the 2017–2018 whole-of-government review launched by President Donald J. Trump's Executive Order 13806, "Assessing and Strengthening the Manufacturing and Defense Industrial Base and Supply Chain Resiliency of the United States," signed on July 21, 2017.[45] Initiated by the White House Office of Trade and Manufacturing Policy and led by the DOD Office of Industrial Policy, this interagency effort identified five macro forces shaping the

industrial base that included the decline of U.S. manufacturing capability and capacity as well as U.S. government business practices. These macro forces manifest themselves in what the final report called "risk archetypes" in the defense industrial base, ranging from single and sole sources of supply to fragile suppliers and markets as well as dependence on foreign suppliers and the erosion of U.S.-based infrastructure.[46]

The report reinforced many previous efforts, but one finding in particular—the "surprising level of foreign dependence on competitor nations"—stood out and became the focus for implementation.[47] Of principal concern were areas in which Chinese firms had become single or sole-source suppliers of critical materials well down the supply chain through mercantilist economic policies and general global supply chain trends. In response, the Administration initiated a significant number of DPA Title III and Industrial Base Analysis and Sustainment program projects to address these shortcomings. These resulted in Presidential Determinations and funding opportunities for capabilities such as small unmanned aerial systems, critical chemicals for missiles and munitions, and heavy and light rare earth separation and processing.[48]

Adapting the Defense Industrial Base to Meet NDS Objectives. The defense industrial base has been financially healthy for most of the past two decades with substantial defense budgets and strong market valuations in the wake of the 9/11 attacks, subsequent long-term military operations in the Middle East, and growing security threats from China and in cyberspace. The basic structure of the industry has similarly remained stable with a handful of large prime contractors that enjoy annual revenues exceeding $15 billion, a larger number of mid-tier companies that are major subsystems suppliers, and a much larger cohort of small businesses and component suppliers. Mergers and acquisitions have continued throughout the industrial base with the exception of consolidation among the top system integrators.

The NDS focus on renewed great-power competition led to significant changes in investment priorities across DOD. In addition to high-tech investment, the overall DOD budget increased, and existing major acquisition programs were overhauled to align with NDS objectives. After almost two decades focused on counterterrorism, however, there were questions about whether the defense industrial base would have the resilience for a rapid ramping up of production in complex major systems such as satellites, aircraft, and ships in the event of a crisis. As noted in the White House 13806 report and the annual industrial capability reports to Congress, there are numerous sectors of the industrial base, such as advanced radars, aircraft, shipbuilding, ground vehicles, and rocket motors, where there often are just two prime contractors.[49]

In addition to these efforts to add capability and capacity to the defense industrial base, there have been a number of initiatives to simplify and increase the speed of the DOD acquisition system. Congressional efforts through the NDAA in the past several years have created authorities, for example, to facilitate the greater use of Other Transactions Authority (OTA) contracts[50] and to create a middle-tier acquisition authority approach.[51] The rationale behind these changes has been to encourage greater innovation and more prototyping both in research and development and in major acquisition programs to help build resilience to meet the dynamic challenges of today's security environment. DOD has put together an Adaptive Acquisition Framework (AAF) to outline these and other "pathways" for acquisition professionals "to develop acquisition strategies and employ acquisition processes that match the characteristics of the capability being acquired" in support of the NDS.[52]

Supply chain security has been a persistent challenge in the defense industrial base. Beyond the entry of companies from adversary countries into lower levels of the supply chain, two principal challenges stand out.

The first of these challenges is supply chain visibility. DOD does its business through contracts with prime contractors, and those contracts hold the prime contractors accountable

for having their subcontractors deliver. As a result, DOD does not have direct visibility into the defense supply chain beyond the prime or tier-one or tier-two levels. Similarly, prime contractors do not have tremendous visibility beyond one or two levels further down the supply chain. Most of the time, this is not an issue, but in certain cases, it can be very difficult. In 2017, for example, a fifth-tier supplier that provided a voltage control switch used in PGMs was purchased, and a subsequent end-of-life buy was insufficient to meet operational demands.[53] This resulted in the rationing of PGMs being used in an operational theater at the time until a longer-term solution was devised.

The second persistent challenge is cybersecurity. The threat to U.S. national security secrets and the damage caused by intellectual property theft in the defense industrial base are well documented and have played a central role in the establishment of DOD's Cybersecurity Maturation Model Certification (CMMC) effort.[54] CMMC is being implemented in 2020 with the goal of full implementation by 2025.

With these changes in investment and in how DOD acquires goods and services, the question remained as to whether the defense industrial base could deliver in the event of major conflict. The unexpected COVID-19 pandemic early in 2020 has provided a partial answer.

The Response to COVID-19

In many ways, the current COVID-19 pandemic has been a testing ground for the ability of the U.S. industrial base to respond to a national emergency because, not surprisingly, the challenges to public health supply chains are similar in many ways to those faced by defense supply chains. For example, while innovation and research and development are strong domestically, the production of personal protective equipment (PPE) and many pharmaceuticals has largely moved offshore.

The limitations of this approach were exposed in the early days of the pandemic when media reports revealed that Chinese firms produce over 50 percent of the world's N95 masks and that they had temporarily halted their mask exports as the virus spread in China.[55] Furthermore, there was the troubling revelation that more than 90 percent of the global production of antibiotics also takes place in China.[56] Much like the White House defense industrial base review, the pandemic has demonstrated the problematic nature of dependent economic relationships with nontransparent economies and undemocratic countries like China for items of strategic importance.[57]

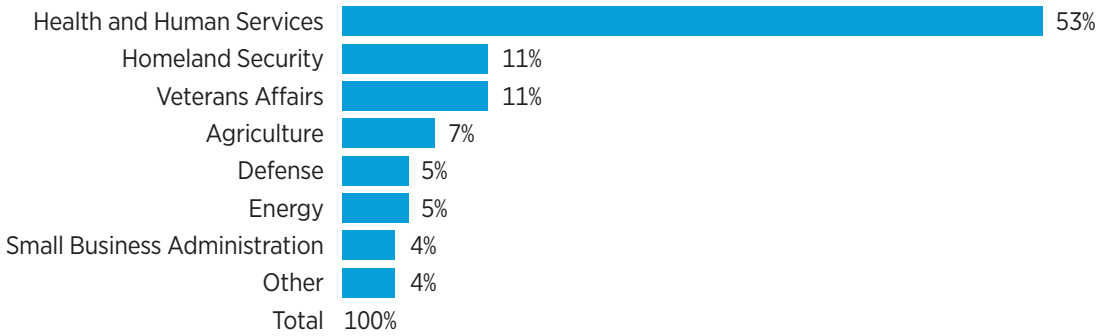
The initial federal response to the pandemic was chaotic, as it would be in any major crisis, but it was clear from the outset that the White House and all U.S. government agencies were pursuing an all-of-the-above approach to acquiring the PPE and equipment needed to treat COVID patients across the country. The Coronavirus Task Force and federal agencies led by the Department of Health and Human Services (HHS) worked with existing producers of ventilators and other health care equipment to surge production to unprecedented levels, and agencies began to release quick-turnaround—even same-day-response—solicitations to purchase PPE from all sources. Some also issued competitions to seek alternative solutions from suppliers that had never before produced health care equipment.[58] Meanwhile, White House advisers such as Director for Trade and Manufacturing Policy Dr. Peter Navarro got on the phone with leaders of commercial firms to find companies willing to adjust production efforts to develop additional sources of ventilators and PPE to meet the exploding number of COVID cases in late March.[59]

On March 13, the President announced that he was invoking the DPA's Title I distribution authority to enable HHS to speed the procurement of PPE and other items. The executive order gave HHS the authority to prioritize contracts and orders to meet national defense and emergency preparedness program requirements, specifically in the "areas of health and medical resources needed to respond to the spread of COVID-19, including personal

CHART 2

Federal Obligations Focused on COVID-19

SHARE OF TOTAL OBLIGATIONS AS OF JUNE 2, 2020, BY DEPARTMENT



NOTE: Department of Defense data are not fully represented due to standard 90–day lag in reporting.
SOURCE: Federal Procurement Data System–Next Generation, https://www.fpds.gov/fpdsng_cms/index.php/en/ (accessed July 10, 2020).

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protective equipment and ventilators."[60] In short order, there were heated debates about whether the President should invoke the DPA Title I allocation authority to direct ventilator production—an action that he largely resisted.[61]

Debates about how various aspects of the DPA might be used in response to the public health crisis tended to dominate media reporting, but these masked the real work that was underway. Government agencies responded immediately to the pandemic by invoking emergency clauses in the Federal Acquisition Regulation (FAR) to delegate approval authority, increase the use of streamlined commercial contracting processes, and increase thresholds to help speed efforts.[62] Funding opportunities in such areas as 3D printing, biofabrication, and textiles[63] as well as collaborative projects between biomedical technology companies and the Army[64] also emerged rapidly. Companies across the spectrum responded to those opportunities to provide solutions during this time of crisis.

The results coming out of the industrial base were dramatic. In just the final week of March, federal obligations focused on COVID-19 rocketed from $636 million on March 24 to just shy of $2 billion by March 31.[65] Cumulative obligations reached over $7 billion as of April 21 and $14 billion by the start of June. Chart 2 breaks down these obligations by government agency.

The Coronavirus Aid, Relief, and Economic Security (CARES) Act further accelerated the immediate response and facilitated medium-term efforts to rebuild the domestic public health supply chain. For the longer-term resilience of that supply chain, the CARES Act added $1 billion to the DPA Fund and removed funding restrictions on individual Title III projects.[66] The tremendous infusion into the DPA Fund was its largest-ever appropriation, and some of these funds have already been used as the Administration has greatly accelerated Title III projects. Whereas, for example, it has taken 18 months to get rare earth Title III projects to the point of award, two COVID-19 pandemic-focused Title III projects, each over $120 million, have been started in less than a month utilizing those DPA funds.[67]

Most important, the impacts of these industrial base efforts were felt in the hospitals on the front lines of the fight against COVID-19. Despite frightening projections and spiking cases in early April, few hospitals suffered lasting shortages of PPE or ventilators, and numerous temporary field hospitals that were constructed were not even used for coronavirus patients.

Building Resilience: Lessons for the Future

COVID was an important testing ground in several aspects, but it was not as challenging to the defense industrial base as, for instance, the development of the B-29 or the atomic bomb were during World War II. Certainly, should the U.S. find itself in a longer-term conflict with an adversary such as China, the ability of our defense industrial base to respond to the destruction or disabling of our F-35 fighters or satellites would present a greater challenge. While DOD investment priorities and contracting approaches continue to prioritize capabilities and capacities focused on great-power competition, the essential question is whether we are building the real resilience that the nation requires to address today's—and tomorrow's—defense challenges.

Overall, our defense industrial base is well postured on at least two fronts.

- The basic authorities, regulations, structures, and tools available to government are solid. Despite some initial hiccups, this structure enabled an effective response to the multifaceted nature of the COVID-19 crisis. Many tools such as OTAs and DPA Title III that are supporting NDS priorities have similarly been deployed effectively during the current crisis.

- Companies across the spectrum are getting involved. Many commercial start-ups and nontraditional contractors engaged with DIU and AFWERX, and other DOD organizations immediately turned their efforts to support pandemic response efforts. One of those companies, for example, pursued and won a series of COVID-19 contracts that began in early April.[68]

There are still gaps and weaknesses that need to be addressed, however. The lack of robust capacity in areas of numerous industrial base sectors such as ground vehicles, shipbuilding, radars, and rocket motors, for instance, raises concerns for potential NDS contingencies. In these and other sectors, there is often one contractor with a preeminent market position and one or more other firms that struggle to keep up. Creating more opportunities for firms to compete for prototype contracts through middle-tier acquisition authority efforts or through OTAs, such as the Army is doing in its revamped timeline for the Optionally Manned Fighting Vehicle, is one way to build industrial capacity to meet NDS objectives.[69]

A recent analysis of the defense industrial base by a major defense trade association and fast-rising analytics firm gave the base a "C" grade based on "a business environment characterized by highly contrasting areas of concern and confidence."[70] Areas of concern included workforce, intermediate goods and services, and raw materials. While the middling overall grade is not terribly surprising, coming as it does from a trade association, it is very interesting to note that some of the highest scores in the report related to the industrial base's productive capacity and surge readiness.[71]

Turning back to the three components that are key for mobilizing the defense industrial base, there are several areas that are ripe for additional action in the coming months:

Capability

- Incentivizing new defense industrial base entrants will continue to be crucial. The trends in commercial technology are only accelerating, so DOD needs to continue to develop and scale business relationships with nontraditional suppliers.

- Eliminating industrial base dependence on China or another competitor nation

is imperative. Utilizing DPA Title III and other authorities or programs to address this dependence will be critical to enabling future crisis responses.

- Increasing the ability of companies and agencies to use rapid and flexible contracting mechanisms will be essential to successful responses to future crises. Carefully assessing the rugby scrum of contracting efforts used in the COVID-19 response, for instance, will help to determine which efforts are most successful at rapidly developing, producing, and delivering the needed capabilities at the needed time so that we are prepared for the future.

Capacity

- Developing DPA Title VII voluntary agreements could help to build the latent capacity of the defense industrial base to address future mobilization efforts.

- Prototyping efforts through OTAs as well as Section 804 middle-tier acquisition authority can help to create additional industrial base capacity akin to that of the numerous aircraft companies in World War II by increasing these prototyping efforts and linking them with production programs.

- Increasing visibility into defense supply chains through an independent third-party mechanism will help to identify capacity challenges in the defense industrial base as they develop and mitigate them before they have an operational impact.

- Stockpiling is a cost-effective way to build capacity in the defense industrial base. Building on the expansion of the Strategic National Stockpile in the CARES Act, DOD should explore ways to build additional capacity by stockpiling resources that are relevant for great-power competition.

Resilience

- Planning and organizing in advance will help to speed future mobilizations of the defense industrial base. Detailed plans and standing organizations are in no way solutions by themselves, but clearly outlining and aligning DPA and other authorities, policies, and responsibilities for future crises and taking an informed approach to planning will help to bring the best aspects of industrial policy to bear for the defense industrial base.

- Finally, the industrial base has clearly become an extended part of the battlefield in today's environment. A catastrophic cyberattack, an antisatellite attack destroying our Global Positioning System network, or a deadly second wave of COVID could cripple facilities or large parts of the defense industrial base with little or no warning. Thus, efforts such as CMMC will be crucial to building longer-term resilience in the defense industrial base.

Conclusion

This examination of past, recent, and ongoing national crises and changes in the national security environment has demonstrated the tremendous dynamism and resilience of our defense industrial base. When the chips are down, our private and public sectors clearly can deliver. From the global conflicts of the 20th century and the post-9/11 world to today's COVID-19 response and era of great-power competition, companies across the industrial base develop and produce systems and solutions to meet our national defense needs. Government agencies and Congress have similarly formed organizations and adjusted policies, created and aligned authorities, and otherwise worked toward the same goal.

Building resilience across our defense industrial base is a national security imperative. The dramatic federal spending on COVID-19 has led to speculation that future defense budget cuts are coming. Given the threats facing the nation and the inherent "stickiness" of

defense budgets, significant cuts (at least in the near term) are not likely.[72] Defense leaders need to use this time to build resilience in our industrial base for the future. Laws, regulations, plans, and policies can enable or inhibit how well the country can mobilize critical assets. There is no silver bullet, but the key is for government and industry to collaborate effectively and transparently to meet our evolving security needs.

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