

DEPARTMENT OF DEFENSE REPORT

State of Competition within the Defense Industrial Base



Office of the Under Secretary of Defense for
Acquisition and Sustainment
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Contents

Reporting Requirement.....	1
Executive Summary	1
Section 1: Overview of Competition and Cross-Cutting Challenges	2
Overview of the State of Competition in the Defense Industrial Base	3
Factors Impacting Competition.....	4
Consolidation in the Defense Industry	4
Data Rights and Intellectual Property	7
Federal-Wide Push to Use Commercial Items.....	12
Section 2: Growing the Small Business Vendor Base	13
Small Business Outreach to Expand the Vendor Base and Ability to Compete	14
Leveraging Small Business Programs to Grow the Industrial Base.....	15
Reducing Barriers to Entry to Support Competition.....	16
Section 3: Defense Industry Outlook—Sectors Where Insufficient Capacity and Competition is a Concern	17
Workforce Constraints and Shortfalls.....	17
Priority Industrial Base Sectors.....	18
Castings and Forgings.....	18
Missiles and Munitions.....	19
Energy Storage and Batteries	20
Strategic and Critical Materials.....	22
Microelectronics.....	22
Conclusion	23
Department Actions to Achieve the Goals of the Executive Order	27

Reporting Requirement

On July 9, 2021, President Biden signed Executive Order 14036, *Promoting Competition in the American Economy*. The Executive Order established the White House Competition Council to coordinate and promote Federal Government efforts to advance competition. Under Section 5 of the Order, the Department of Defense (DoD) was directed to submit a report to the Chair of the White House Competition Council reviewing the state of competition within the defense industrial base (DIB), including areas where a lack of competition may be of concern and any recommendations for improving the solicitation process.

Executive Summary

Competition within the DIB is vital to the Department for several reasons. When markets are competitive, the Department reaps the benefits through improved cost, schedule, and performance for the products and services needed to support national defense. During initial procurement, incentivizing innovation through competition drives industry to offer its best technical solutions at a best-value cost and price. During contract performance, the expectation that contractors will have to compete against other firms in the future encourages them to perform effectively and efficiently.

Competition is also an indicator of the necessary industrial capability and capacity to deliver the systems, key technologies, materials, services, and products the Department requires to support its mission. Insufficient competition may leave gaps in filling these needs, remove pressures to innovate to outpace other firms, result in higher costs to taxpayers as leading firms leverage their market position to charge more, and raise barriers for new entrants. Moreover, having only a single source or a small number of sources for a defense need can pose mission risk and, particularly in cases where the existing dominant supplier or suppliers are influenced by an adversary nation, pose significant national security risks. For all these reasons, promoting competition to the maximum extent possible is a top priority for the Department.

Since the 1990s, the defense sector has consolidated substantially, transitioning from 51 to 5 aerospace and defense prime contractors.¹ As a result, DoD is increasingly reliant on a small number of contractors for critical defense capabilities. Consolidations that reduce required capability and capacity and the depth of competition would have serious consequences for national security. Over approximately the last three decades, the number of suppliers in major weapons system categories has declined substantially: tactical missile suppliers have declined from 13 to 3, fixed-wing aircraft suppliers declined from 8 to 3, and satellite suppliers have halved from 8 to 4. Today, 90% of missiles come from 3 sources.² As a result, promoting competition and ensuring it is fair and open for future programs is a critical Department priority.

This report lays out five broad recommendations to spur increased competition in the DIB:

- *Strengthening Merger Oversight.* DoD faces a historically consolidated DIB, making heightened review of any further mergers and acquisitions (M&A) necessary. Moreover, when a merger threatens DoD interests, DoD will support the Federal Trade Commission

¹ See *Final Report of the Commission on the Future of the United States Aerospace Industry*, November 2002, p. 134, <https://history.nasa.gov/AeroCommissionFinalReport.pdf>.

² Source: 2020 DCMA Munitions Industry Production Analysis and July 2020 DCMA Missile Sector Economic Assessment.

(FTC) and Department of Justice (DOJ) in antitrust investigations and recommendations involving the defense industrial base.

- *Addressing Intellectual Property Limitations.* Certain practices surrounding intellectual property (IP) and data rights have been used to limit competition in DoD purchasing and to induce “vendor-lock” and other undesirable results. DoD will implement best practices for identifying its long-term IP needs early in the competitive phases of acquisition programs, ensuring IP is an evaluation factor in competitive awards and a negotiation objective in sole-source awards, and contracting with vendors who are willing to provide the government the IP deliverables and rights it needs. In its ongoing modernization of its approach to IP rights, DoD should do what it can to create IP-related procedures that do not result in unnecessary anticompetitive consequences.
- *Increasing New Entrants.* To counteract the trend of overall shrinking of the DIB, DoD should endeavor to attract new entrants to the defense marketplace by reducing barriers to entry. This will be accomplished through small business outreach, support, and use of acquisition authorities like other transaction (OT) authority and commercial solutions opening (CSO) that provides DoD the flexibility to adopt and incorporate commercial best practices to reduce barriers and attract new vendors.
- *Increasing Opportunities for Small Businesses.* DoD should increase small business participation in defense procurement, with an emphasis on increasing competition in priority industrial base sectors.
- *Implementing Sector-specific Supply Chain Resiliency Plans:* DoD should take steps to ensure resiliency in the supply chain for five priority sectors: casting and forgings, missiles and munitions, energy storage and batteries, strategic and critical materials, and microelectronics. Detailed recommendations are included in DoD’s report on Executive Order 14017, *America’s Supply Chains*.

Section 1 of this report provides an overview of the state of competition in DIB and introduces cross-cutting challenges and recommendations related to M&A, IP, and reliance on commercial items. Section 2 focuses specifically on the health of the small business DIB and recommendations to increase the small business vendor base. Section 3 provides a sectoral assessment across five priority areas, with recommended mitigations across each of these areas.

DoD is committed to pursuing these principles throughout its procurement and sustainment processes. These efforts to increase competition will deliver benefits for cost, schedule, quality, performance, innovation, and industrial capacity. These efforts will also enhance its capability to meet mission demands and national security requirements.

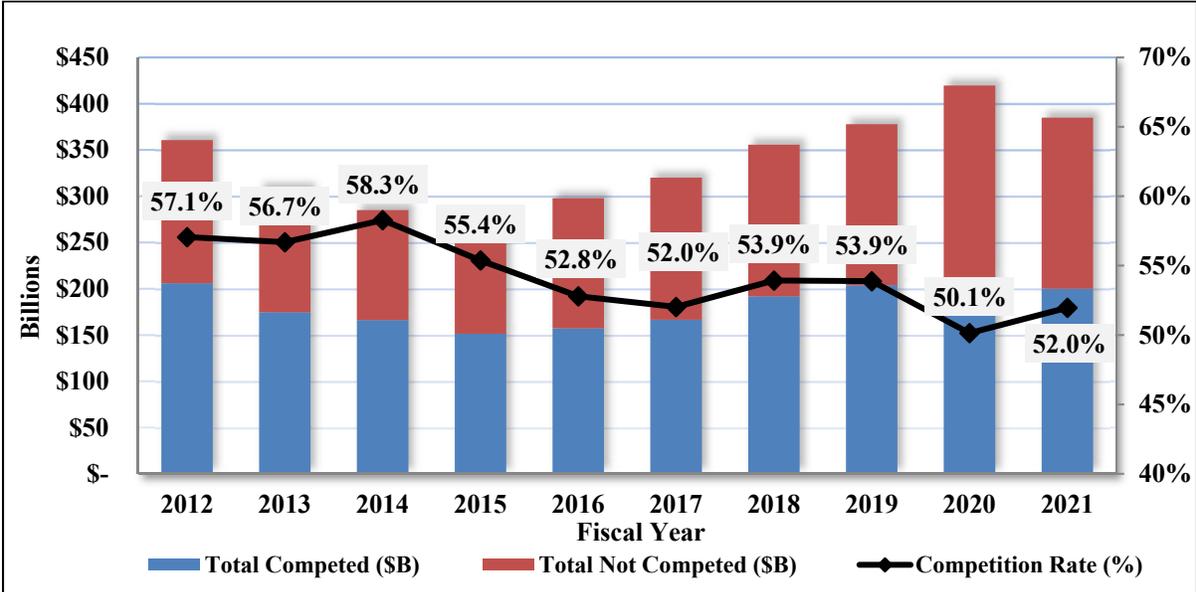
Section 1: Overview of Competition and Cross-Cutting Challenges

Competition within the DIB is critical to national and economic security. It spurs innovation of transformational technologies, incentivizes contractors to offer lower prices, and yields improvements in quality. This report reviews the current state of competition, discusses systemic challenges to expanding competition, and describes the positive actions that DoD is taking to broaden its competitive base. DoD’s efforts are designed to increase competition and build domestic capacity, especially from small businesses, and to close gaps in the domestic national security and technology industrial base.

Overview of the State of Competition in the Defense Industrial Base

DoD tracks competition by obligations³ and contract actions based on data from the Federal Procurement Data System—Next Generation (FPDS-NG). The FPDS-NG competition report measures competition and fair opportunity at the contract and order level. The competition rate is calculated as either the dollars obligated for competitive contracts (i.e., two or more offerors) divided by the total dollars obligated, or the number of contract actions for competitive contracts divided by the total number of contract actions. The competition rate varies depending upon the mission and type of product or service being procured. Competition rates also differ greatly depending on whether the calculation uses obligations or contract actions. The DoD competition rate based on dollars obligated is typically in the 50-60% range; if based on the number of contract actions, the competition rate would be consistently in the 90% range.

The competitive environment for the DIB remained relatively stable over the past several years. Over the past ten years, DoD has seen total dollars obligated vary from a high of \$420 billion in Fiscal Year (FY) 2020 to a low of \$273 billion in FY 2015. During that time, the competition rates ranged from a high of 58.3% in FY 2014 to 50.1% in FY 2020, and projected at 52% for FY 2021, for a ten-year average of 54.2%. Figure 1 displays the ten-year trend for competitive and non-competitive dollars obligated, with the peak of \$420B total dollars obligated in FY 2020 due to increased obligations for COVID-19 related actions.



Note: Dollars shown in billions

Figure 1: Ten-year trend for DoD competitive and non-competitive dollars

To help improve its tracking of competition within the DIB, DoD developed a Procurement Business Intelligence Service Competition Analysis Scorecard to report competition rates at the

³ Obligations refers to the funds reserved in the accounting system upon contract award. Those dollars are obligated under the contract for expenditure.

product service code and broader portfolio group levels.⁴ The competition scorecard provides dashboard-like presentations to help components track and analyze competition trends in portfolio groups for major weapon system platforms (e.g., aircraft, ships, and land vehicles), electronic and communications equipment, and their associated sustainment phases. Historically, these portfolio groups report competition rates in the 15–40% range for dollars obligated, which has a significant impact on DoD’s overall competition rate since these weapon systems and major equipment account for a sizeable portion of the total dollars obligated. The competition scorecards provide management-level reports and tools to enable informed business decisions that support procurement policies with the goal of improving competition in the DoD supply chain and industrial base.

Similarly, securing competition varies widely based upon the mission and type of product or service being procured. Generally, those contracting organizations supporting installation-level mission support and logistical requirements (e.g., food service, facility maintenance, grounds maintenance, transportation services) and/or depot-level maintenance services requirements (e.g., contractor logistics support for spare parts) have multiple potential suppliers resulting in very high competition rates. This is also true for contracting organizations heavily involved in services, commercial products, and construction.

The competitive percentages are lower in organizations that procure major systems (e.g., weapons, automated information systems), specialized equipment, spares (especially on aging weapon systems), and upgrades that may need to be purchased from the original equipment manufacturer (OEM) or supplier. These programs can require sole-source extensions of contracts that were originally competed because the programs have moved past the stage in their lifecycle where competition is economically viable. These sole-source transactions are made in accordance with statutory requirements that authorize dealing with only one source.

Factors Impacting Competition

Consolidation in the Defense Industry

During the 1990s, the U.S. defense industry underwent drastic consolidation. As an example, the number of aerospace and defense prime contractors shrank from 51 to 5: Lockheed Martin (LM), Raytheon, General Dynamics (GD), Northrop Grumman (NG), and Boeing.⁵ The trend toward consolidation has continued in the last five years, due to vertical and horizontal integrations and the entry of private equity firms performing roll ups.

A few key factors help explain consolidation trends in the defense industry.

- Consolidation in the U.S. defense industry historically increases under budget reduction pressures and slows during periods of growth. A 2018 study showed that M&A transaction volumes averaged \$10–\$11 billion annually during U.S. defense spending

⁴ Product service codes describe the types of goods or services that a contract predominantly contains. Portfolio groups were established under DoD’s Better Buying Power initiative to group together similar product service codes into categories to allow for more streamlined procurements, similar to the government-wide category management spend categories.

⁵ See *Final Report of the Commission on the Future of the United States Aerospace Industry*, November 2002, p. 134, <https://history.nasa.gov/AeroCommissionFinalReport.pdf>.

downturn periods, compared with \$4.5 billion annually during the 9-year growth cycle following 9/11.⁶

- Low interest rates make capital cheaper and more accessible for acquiring firms, facilitating greater M&A activity.
- DoD major systems development programs take years to progress from initial requirement through design, prototyping, initial production, testing, full production, operational fielding, and sustainment. Opportunities for new programs can be limited, driving unsuccessful bidders to exit the market when it is unsustainable to maintain design and manufacturing skills until the next requirement presents itself.

Consolidation and market concentration generally lead to reduced competition and creates sourcing risk. Table 1 captures examples of the reduction of suppliers over the past twenty years for major weapons categories, such as tactical missiles declining from 13 suppliers to 3 suppliers, fixed-wing aircraft declining from 8 suppliers to 3, and satellites declining from 8 suppliers to 4.

Weapons category	Total U.S. contractors			Current U.S.-based prime contractors
	1990	1998	2020	
Tactical missiles	13	3	3	▶ Boeing ▶ Lockheed Martin ▶ Raytheon Technologies
Fixed-wing aircraft	8	3	3	▶ Boeing ▶ Lockheed Martin ▶ Northrup Grumman
Expendable launch vehicles	6	2	2	▶ Boeing ▶ Lockheed Martin
Satellites	8	5	4	▶ Boeing ▶ Hughes ▶ Lockheed Martin ▶ Northrup Grumman
Surface ships	8	5	2	▶ General Dynamics ▶ Huntington Ingalls
Tactical wheeled vehicles	6	4	3	▶ AM General ▶ General Motors ▶ Oshkosh
Tracked combat vehicles	3	2	1	▶ General Dynamics
Strategic missiles	3	2	2	▶ Boeing ▶ Lockheed Martin
Torpedoes	3	2	2	▶ Lockheed Martin ▶ Raytheon Technologies
Rotary wing aircraft	4	3	3	▶ Bell Textron ▶ Boeing ▶ Lockheed Martin (Sikorsky)

Table 1. Fewer contractors exist for major weapons categories⁷

Although studies of this trend have not found a strong correlation between consolidation and increased program pricing, additional risks beyond pricing come with consolidation. Growing

⁶ FY17 National Defense Authorization Act Study: Preserving Competition in the Defense Industry, Boston Consulting Group, 2018, p. 4.

⁷ Office of Commercial and Economic Analysis (OCEA) U.S. Aerospace & Defense Industry Consolidation Assessment, November 2021. Sources and information included CSIS, Bloomberg, Defense News, National Defense, Center for Defense, GAO, POGO.

concentration can reduce the availability of key supplies and equipment, diminish vendors' incentives for innovation and performance in government contracts, and lead to supply chain vulnerabilities.

DoD Action: Mitigating the Effects of Mergers and Acquisitions and Consolidation on Competition

Per DoD Directive 5000.62, DoD continues to assess, on its merits, each M&A transaction that could impact the DIB, analyzing the effect on “national security, the industrial and technological base, innovation, or any other potential issue including those relating to the public’s interest.”⁸ The Department independently assesses proposed mergers and makes a recommendation to the lead antitrust agency for that transaction. If the transaction would result in anticompetitive impacts, the antitrust agencies can implement behavioral or structural remedies. DoD, however, may have concerns that go beyond those specified in the antitrust analysis, such as concerns related to mission risk or national security risk.

When evaluating a merger, DoD assesses whether adverse competitive effects have occurred or are likely to arise in the future. M&A is broken down into two types: *horizontal mergers* in which firms acquire businesses that overlap with products or services and *vertical mergers* in which firms purchase companies in their supply chain. Both types of mergers may present competition concerns, although the defense industry has seen an increase in vertical mergers in recent years.⁹ Horizontal mergers raise concerns when the acquirer is able to raise prices, reduce output, diminish innovation, or otherwise harm customers as a result of diminished competitive constraints or incentives.¹⁰ Vertical mergers can raise concerns when the vertically integrated firm has the ability and incentive to take anticompetitive actions that provide it an advantage over competitors. The primary theories of anticompetitive behavior in vertical mergers are a) foreclosure (i.e., closing off a key input to competitors required for a system or product), b) raising rivals' costs, and c) access to competitively sensitive information. The defense industry can be more vulnerable to foreclosure compared to other industries given DoD's unique requirements and frequent position as the only customer for a particular product or service.

The Department works closely with the antitrust agencies who have the authority to ensure the appropriate remedy is implemented to address potential impacts caused by anticompetitive risks that could result from a proposed transaction. When a merger is likely to negatively affect the Department, the antitrust agencies will typically recommend structural remedies (such as divestitures, or blocking the merger) or, in limited cases, behavioral remedies (such as a consent order) if they believe the risk can be mitigated.

In addition to aiding the antitrust agencies, the Department's assessments provide a fact-based analysis of the risks, issues, and opportunities that help establish strategies and consider investments in specific areas necessary to protect and promote the U.S. technology and innovation base. In 2020, the Office of the Under Secretary of Defense for Research and

⁸ DoD Directive 5000.62 “Review of Mergers, Acquisitions, Joint Ventures, Investments, and Strategic Alliances of Major Defense Suppliers on National Security and Public Interest”, effective February 27, 2017, <https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodd/500062p.pdf>.

⁹ See for example, Rodrigo Carril & Mark Duggan, 2020. “The impact of industry consolidation on government procurement: Evidence from Department of Defense contracting,” *Journal of Public Economics*, vol 184.

¹⁰ See DOJ and FTC Horizontal Merger Guidelines, Aug. 19, 2010.

Engineering (OUSD[R&E]) executed assessments that informed strategies and investment decisions in areas like hypersonics, directed energy, and biotechnology.

OUSD(R&E) subject matter experts regularly participate in assessments to determine the effect of foreign transactions, export controls, M&A, and market distribution on national security across R&E modernization priorities as well as technology-related events in general. Results of these assessments are used to create a balance between promoting and protecting the technology and innovation base with the goal of sustaining competition without impacting national security.

In doing so, addressing IP rights and the impact on competitive business models is one of the critical elements that must be proactively addressed in developing, producing, supporting, and modernizing cutting-edge technology-based capabilities. On the one hand, IP rights encourage technology innovations that are critical to DoD's capabilities and mission by enhancing the return on investment for those entities that invest in creating such technology. However, exclusive IP rights also have the potential to restrict open competition for the new technologies, once created.

Data Rights and Intellectual Property

IP, as a return-on-investment model, both encourages and restricts competition. From a technology standpoint, the IP statutory and regulatory framework drives competition to create innovative technology as a prerequisite to qualify for IP protection. From a business standpoint, the resulting IP protection itself establishes a form of limited monopoly to commercialize that new technology, creating tension with competition. IP, as a form of legal protection, grants exclusive or limiting rights to individuals (e.g., inventors or authors) for their intellectual creations, such as inventions, works of art or music, or technical know-how. The exclusive rights and legal remedies granted to IP owners are not undesirable or problematic merely because they may restrict full and open competition for technologies protected by those exclusive IP rights. In fact, IP rights can serve as an incentive to greater innovation. The government must recognize and plan for the impact of such rights, and use competitive pressure, its market power, and all the other tools available to mitigate against undesirable restrictions on competition when utilizing cutting-edge technology protected by IP rights.

In the defense sector, procurements operate under a unique system for allocating rights for use of technical data and computer software based on a combined licensing of the underlying copyrights and trade secret protection—collectively referred to as “data rights.” This data rights regime generally allocates greater rights to the entity (government or contractor) that funded the *development* of the underlying technology (hardware or software). However, under various statutes, regulations, and case law, some forms of government investment are categorized as contractor funding. For example, government development funding paid via independent research and development (R&D) reimbursement are later treated as contractor funding in any follow-on procurement contract. DoD can also contractually require unlimited rights for certain technical data regardless of who funded development (e.g., data necessary for operation, maintenance, installation, or training (OMIT) activities, or form, fit, and function data to enable interchangeability of functionally equivalent components).

This funding-based approach to allocating IP rights is based on a statutory foundation that has existed since the mid-1980s. These rules, requested and long supported by industry, are enabled by taking advantage of the existing features of the data rights rules and the economics of the

defense marketplace. This poses challenges in the later stages of the acquisition program lifecycle, after the government has selected the sources of its products and is seeking to foster competition for product support and upgrade of the selected vendors' products, which typically are protected by IP restrictions. To address these long-term restrictions on competitive sourcing, the government must take action earlier in the program lifecycle, leveraging competitive source selection to work with vendors to establish long-term business models that allow for increased competition while respecting the vendors' privately developed IP rights.

To do so, DoD should anticipate, plan for, and counter the following considerations and practices that can be used to limit competition:

No compulsory licensing beyond the regulatory standard rights, regardless of what is actually needed. Statutory and regulatory restrictions prohibit requiring greater than the regulatory-standard data rights licenses as a condition of awarding a contract, and discourage the offer of proprietary technology with data rights restrictions.¹¹ DoD personnel and defense contractors often misunderstand or misconstrue rules that carve out detailed manufacturing and process data (DMPD) from DoD's ability to require unlimited rights in data for OMIT activities.

One way to address these challenges is to ensure that the program's long-term IP requirements are integrated appropriately into source selection evaluation factors, to ensure the government is planning for the IP-based risks to its long-term program competition goals, and to incentivize contractors to furnish the necessary data deliverables and license rights to promote later competition. Addressing IP challenges at this stage can be especially effective because multiple contractors are competing for the first contract and have a greater competitive incentive to provide the technical data rights as a means of securing the contract. In other words, DoD should be seeking to deal at the outset with contractors who provide the rights needed by the government.

Tying or bundling—and its relation to modularity and Modular Open Systems Approaches. Defense contractors frequently leverage a feature in the data rights scheme related to allocating license rights based on source development funding. This feature has been known historically and formally as the doctrine of segregability, and more recently and informally as the doctrine of modularity, or modular licensing. This concept allocates license rights based on the source of funding for the development of the technology with the assessment of the funding source at the "lowest practicable segregable level" of the system architecture. In practice, this may result in discrete subsystems or components of a larger system being categorized as developed exclusively at private expense and therefore subject to the most significant license restrictions (e.g., limited rights in technical data, or restricted rights in noncommercial computer software). Since these license rights generally do not allow release of the data or software for competition, this practice can supply the government with gaps in data rights in a system or subsystem—sometimes referred to as "Swiss cheese" data rights.

This terminology refers to the scenario in which a system or subsystem that was developed mostly or significantly at government expense (resulting in licensing allowing use and release for competition) may also have discrete subsystems or components that were privately developed

¹¹ See 10 U.S.C. § 2320(a)(2)(H), which is implemented at DFARS 227.7103-1(c) and (d) for noncommercial tech data, and extended by policy to noncommercial computer software at DFARS 227.7103-1(c) and (d). In addition, similar long-standing policies and practices for commercial technologies are implemented at DFARS 227.7102-1 for commercial tech data, and DFARS 227.7202-1 and -3 for commercial computer software.

(and subject to licensing prohibiting such competitive use or release). In such a case, DoD would be unable to release the complete, detailed data package and data rights covering the entire system for a competitive product support effort, due to the restrictions on those portions of the data covering the proprietary components. If that proprietary data were excluded from the data package, the remaining data may be released for competition, but the data package would be incomplete (i.e., it is said to have “holes” in it or Swiss cheese data rights), rendering overall use for competition impracticable. This circumstance limits competition on much larger systems funded substantially by the government.

To proactively mitigate against such IP-based restrictions on competition, DoD can utilize a variety of techniques and countermeasures, such as using a modular open systems approach (MOSA) to manage the proprietary components as “black boxes,” negotiating specialized license agreements, or a combination of the two. MOSA combines system engineering open architecture techniques with open licensing and related legal and business considerations to isolate proprietary technology and prevent overleveraging of limited private investments from undermining return on government investment. MOSA enables the government to limit the impact of restrictions on privately developed components by treating those components at technology as proprietary “black boxes” that are described with releasable “form, fit, or function” data¹² and well-defined and described interfaces to the remainder of the system components. This allows other vendors to identify suitable alternatives for the proprietary black boxes, or, if necessary to contract with the OEM for support for those black boxes, limit such sole-source efforts to the black box itself.

Alternatively, or in conjunction with MOSA, the government can mitigate the IP restrictions on proprietary components by negotiating specialized license agreements that better balance the government’s and vendors’ interests than the Defense Federal Acquisition Regulation Supplement (DFARS) standard license rights, or the vendor’s customary commercial license. The DFARS allows and encourages the parties to negotiate specialized license agreements for all data rights scenarios, including technical data and computer software for commercial and noncommercial products, for developmental and nondevelopmental technologies, or any combination of such characteristics. In all cases, the negotiation of any specialized license must occur through voluntary, mutual agreement of the parties. Accordingly, the government has a compelling interest in entering into such negotiations in a competitive environment to the maximum extent possible, to leverage its market power and incentivize the vendors to enter into agreements that encourage the competitor to develop business models and provide corresponding offers that better balance both parties’ interests in ensuring return on their technology investments, while promoting and enhancing DoD options for increased competition throughout the lifecycle of the program.

To effectively implement these mitigations and countermeasures to IP-based restrictions on competition, DoD should do so early in the program lifecycle—to leverage competitive pressures and government market power to the maximum extent practicable. This requires the government to develop IP strategies at program inception, and to ensure that those strategies plan for the

¹² The DFARS framework provides DoD with the ability to require unlimited in rights in form, fit, or function data, which is defined as “technical data that describes the required overall physical, functional, and performance characteristics (along with the qualification requirements, if applicable) of an item, component, or process to the extent necessary to permit identification of physically and functionally interchangeable items”. See DFARS 252.227-7013 paragraphs (a)(11) and (b)(1)(iv).

program's long-term needs to preserve and enable competition throughout the lifecycle. To do so, these IP strategies must be integrated with other program analyses and strategies, such as the product support analysis and lifecycle support plan, and the program's acquisition strategy. The effective integration of these strategies requires a cross-functional team effort, including subject matter experts from program management, engineering, contracting, law, sustainment, logistics, cost and pricing, and financial analysis. Accordingly, DoD is dedicating significant effort to training and educating its acquisition workforce, including modernizing its IP policies, regulations, and training resources.

DoD Action: Modernizing Intellectual Property Policy, Regulations, Guidance, and Training

In October 2019, DoD published DoD Instruction (DoDI) 5010.44, *Intellectual Property (IP) Acquisition and Licensing*. This DoDI created a DoD-wide policy to govern and unify the acquisition, licensing, and management of IP, implementing the statutory requirements of 10 U.S.C. § 2322(a). A critical element for supporting consistent implementation of these policies and best practices, this DoDI established the DoD IP Cadre, a DoD-wide, cross-functional team of IP experts. The DoD IP Cadre is organized using a federated structure, with a new office established in the Office of the Secretary of Defense (OSD) to coordinate with other offices and functional experts throughout OSD, the military departments, and other DoD components to advise and support DoD programs and the acquisition workforce.

The new IP policy cites six core principles for guiding the DoD IP Cadre's program support and workforce training activities:

1. Integrate IP planning fully into acquisition strategies and product support strategies to protect core DoD interests over the entire lifecycle. Seek to acquire only those IP deliverables and license rights necessary to accomplish these strategies, bearing in mind the long-term effect on cost, competition, and affordability.
2. Ensure acquisition professionals have relevant knowledge of how IP matters relate to their official duties. Cross-functional input and coordination is critical to planning and lifecycle objectives.
3. Negotiate specialized provisions for IP deliverables and associated license rights whenever doing so will balance DoD and industry interests more effectively than the standard or customary license rights. This is most effective early in the lifecycle, when competition is more likely.
4. Communicate clearly and effectively with industry regarding planning, expectations, and objectives for system upgrade and sustainment. Avoid requirements and strategies that limit DoD's options in accessing vital technology and commercial solutions available from industry.
5. Respect and protect IP resulting from technology development investments by the private sector and the government.
6. Clearly define and match data deliverables with the license rights in those deliverables. Data or software deliverables are of no value unless and until the license rights to use it are attached and the government obtains and accepts those deliverables.

DoD is implementing these core IP principles through a variety of mechanisms, including conducting rulemaking in multiple pending cases to revise the IP coverage in the DFARS. Most of the cases relate to data rights statutory and government-wide policy changes, addressing issues such as IP pricing and valuation, establishing a preference to utilize specially negotiated licenses, additional planning requirements and license rights to better enable MOSA, and improvements to the data rights licensing and procedures in the Small Business Innovative Research (SBIR) and Small Business Technology Transfer (STTR) programs. This rulemaking will take years due to its extensive scope and “enhanced engagement”¹³ approach to gather industry inputs early in the drafting of these regulatory changes to modernize many aspects of DoD acquisition of IP rights.

In addition, the forthcoming *Intellectual Property: A Strategic and Tactical Guidebook* (IP Guide) will support acquisition business process revision as part of Adaptive Acquisition Framework implementation.¹⁴ The IP Guide, combined with supporting training and integration of its use within DoD’s business processes, will help DoD secure the necessary technical data and associated rights to enable greater competition through the sustainment of the major system. Specifically, the IP Guide will:

- Describe legal and practical challenges to acquiring the data and associated rights to support the DoD mission, especially for developing, fielding, and sustaining weapon systems (including maintenance and repair);
- Explain needs-determinations for data and associated rights and how various policies in statute and regulation designed to balance the interests of government and industry create these challenges to meeting DoD IP needs;
- Offer pointers and practices for better negotiating these challenges tactically and explain how to create government strategies to address industry approaches that limit competition based on IP restrictions;
- Provide guidance on IP valuation and evaluation considering DoD technology needs, return on investment for government and industry, and the strength and breadth of the DIB, including small businesses and non-traditional defense contractors;
- Address technical enablers, such as MOSA, and special technical needs, such as technical data or software for cybersecurity and supply chain risk management;

¹³ DoD agreed to implement an “enhanced engagement” approach to DFARS IP revisions as part of its assessment and implementation of issues and recommendation of the Government-Industry Advisory Panel established pursuant to Section 813 of the National Defense Authorization Act for FY 2016. This approach functions as an exception to the normal rulemaking process, including inviting industry to participate in public meetings earlier in the drafting stages of the rule.

¹⁴ The Adaptive Acquisition Framework enables Program Managers to choose the right pathway to deliver their capability to the warfighter as quickly as possible. It empowers innovation and common-sense decision-making throughout the process while maintaining discipline in practices and procedures. The six pathways are urgent capability acquisition—to field capabilities to fulfill urgent existing or emerging operational needs or quick reactions in less than 2 years; middle tier of acquisition—to rapidly develop fieldable prototypes in an acquisition program to demonstrate new capabilities or rapidly field production quantities of systems with proven technologies requiring minimal development; major capability acquisition—to acquire and modernize military unique programs for enduring capability; software acquisition—to facilitate rapid and iterative delivery of software capability (e.g., software-intensive systems or software-intensive components or subsystems) to the user; defense business systems—to acquire information systems supporting DoD business operations; and acquisition of services—to acquire services from the private sector, including knowledge-based, construction, electronics and communications, equipment maintenance, facilities, product support, logistics, medical, research and development, and transportation services.

- Explain the extensive and intricate regulations on data and patent rights and the procedures for ordering data properly; and
- Evolve as a living document, with frequent updates due to the pending DFARS IP-related public rulemaking activities, and as lessons are learned from the 2020 National Defense Authorization Act Section 801 pilot program considering the best practices and techniques for valuing and evaluating IP.

Federal-Wide Push to Use Commercial Items

In the 1990s, the federal government streamlined acquisitions by highlighting the importance of commercial items. In the Federal Acquisition Streamlining Act (FASA), the government set out a broad definition of commercial items to speed procurement time and manage tax dollars via a competitive marketplace. FASA included a preference for Commercial off the Shelf (COTS) items instead of the time-consuming and expensive process of creating government-unique items. The Federal Acquisition Reform Act extended the theme through the following changes to procurements of commercial items: exempting such contracts from the requirements to submit certified cost and pricing data, allowing simplified procedure use up to \$5 million, removing certain contracting provisions for COTS items, and eliminating the requirement for cost accounting standards.

Since then, DoD has dramatically increased the use of commercial item procurements. According to DoD contract award data from the Federal Procurement Data System, the early 2000s saw commercial items make up 30–50% of all procurements. Since 2011, commercial items have consistently accounted for over 88% of new awards (and as high as 98% of new awards) across DoD. The early efforts to push the Department toward procuring commercial items has clearly resulted in increased commercial item procurements, which has brought with it benefits to competition as the vast majority of commercial items and services are acquired on a competitive basis, and cost and schedule efficiencies by leveraging existing commercial solutions.

However, the government's increasing reliance on commercial or commercial-derivative technologies, even as components within defense-unique systems, erodes its ability to secure the detailed, proprietary IP needed for organic or competitive support to that defense system throughout its lifecycle. Defense systems are often complex systems of systems, with each system further decomposed into subsystems, subsystems decomposed to components, and so on. The supporting IP model for commercial or non-developmental (i.e., that the customer will not receive detailed IP deliverables or the license rights to use or release that commercial IP for competition with the IP owner) puts the government at greater risk of becoming vendor-locked for critical sub-elements of these complex systems. If a component or subsystem becomes vendor-locked, the process for acquiring, supporting, and upgrading the overarching system or subsystem can be subject to the pressure of that vendor lock, because the overall support for that system depends on the exclusive IP rights governing a critical subsystem or component.

The preceding discussion outlines the challenges in securing the IP and data rights and some of the systemic challenges to expanding competition within the DIB. However, there are also many opportunities and efforts ongoing to expand the industrial base and address these challenges to expand competition.

DoD Action: Attracting Non-Traditional Vendors—Other Transactions and Commercial Solution Openings

The OT and CSO authorities give DoD the flexibility to adopt and incorporate business practices that reflect commercial industry standards and best practices. The underlying concept of OTs has existed for more than 60 years and has been available to DoD for research OTs since 1989 and for prototype OTs since 1994. In 2016, the prototype authority was expanded to include follow-on production. Previously, OTs only covered R&D and, once a capability developed enough to warrant production, a traditional FAR-based contract followed. This transition presented a significant disincentive to non-traditional defense contractor (NDC) engagement. The production authority incentivizes participation from more NDCs to enable the transition from prototype to production with the goal of becoming part of the government's solutions ecosystem.

In 2017, Congress granted DoD the authority to implement a pilot program to acquire innovative commercial items, technologies, and services, commonly known as CSO authority, under a FAR-based construct. This authority, now permanent, spurs innovation among traditional defense contractors, attracts companies with leading-edge technologies, and adapts business practices to explore innovative technology more rapidly.

OT use has grown significantly over the past few years, more than doubling from FY 2019 to FY 2020. The R&D sector has seen an increase in vendors of about 9% over the past ten years, while most sectors have seen a decline in the number of vendors despite increased dollars spent. Some of this can be attributed to leveraging these new authorities. Most of the growth in FY 2020 was for R&D on COVID-19 vaccines and therapeutics, demonstrating the ability of OTs and CSOs to access innovative, non-traditional firms with technical solutions to support the DoD mission. Consistent with the intent of the authority, most obligations were competitively awarded to NDCs. OTs, when leveraged appropriately, supply DoD with access to state-of-the-art technology solutions from traditional contractors and NDCs through a multitude of teaming arrangements tailored to the project and the needs of the participants. OTs and CSOs foster new relationships and practices involving traditional and NDCs, especially those not interested in FAR-based contracts to support dual-use projects; encourage flexible, quicker, and cheaper project design and execution; and leverage commercial industry investment in technology development. The increased flexibility broadens the industrial base by leveraging commercial industry investment in technology development to incorporate DoD requirements into future technologies and products.

Section 2: Growing the Small Business Vendor Base

Small business participation in defense procurements as prime and subcontractors is vital to the defense mission, competition, and the health of the DIB. Small businesses spur innovation, represent the majority of new entrants into the DIB, and, through their growth, create a pipeline of the next generation of suppliers with diverse capabilities to support the DoD mission. They are also essential to the nation's economic prosperity. Small companies hire 43% of all high tech jobs in the country, produce 16.5 times more patents than large firms, and generate 44% of the nation's economic activity. The ingenuity, agility, and capabilities of these firms are inextricably tied to the nation's national and economic security.

In 2021, DoD's efforts to increase small business participation in the defense ecosystem reached several key milestones. The Department received an "A" from the Small Business

Administration for meeting its contracting goals for 7 straight years. Reaching an all-time high, DoD spent \$80.3 billion with small businesses, with 45% of those awards going to disadvantaged or woman-owned businesses; and in the past 10 years, DoD dramatically increased small business spending in R&D by 83%. In that same time, DoD expanded spending in small business manufacturing by 28%. Yet, over the past decade, small businesses in the DIB shrunk by over 40%. According to Deputy Secretary of Defense Kathleen Hicks, the data shows that if the DIB continues along the same trend, DoD could lose an additional 15,000 suppliers over the next 10 years. This downward trend is a national security and economic risk to the nation that could lead to a decline in key domestic capabilities and requires swift action to reverse.

Small Business Outreach to Expand the Vendor Base and Ability to Compete

To support expanding the vendor base, DoD is increasing outreach and engagement with industry, simplifying information on opportunities to do business with the Department, and providing support to small businesses that seek to enter the defense marketplace. DoD conducts monthly calls with industry associations that have significant small business membership, hosts quarterly meetings with industry associations representing minority and women-owned small businesses, and leverages the Procurement Technical Assistance Program (PTAP) and small business professionals in the military services and defense agencies to organize outreach events, industry days, and matchmaking events. DoD is also streamlining dissemination of information and opportunities to small businesses by turning its small business website, business.defense.gov, into a single point of entry for small businesses. On this website, companies can find toolkits on how to do business with DoD and information on programs and offices that work with small businesses across DoD.

As a part of DoD's overall small business strategy, the Department will create a unified governance structure of small business programs and activities that will create more synergies and transition pathways between these programs. Additionally, DoD is developing market intelligence tools that will help the acquisition workforce identify capable suppliers in the federal and commercial marketplace that could perform on defense requirements. This, in turn, will increase the number of contracts set aside for small business competition.

DoD is also helping small businesses to become "DIB ready" so they are prepared to do business with DoD and other federal agencies. DoD's PTAP program supports 96 Procurement Technical Assistance Centers (PTACs) across the country that provide counseling services and training to small businesses while also helping them identify potential contract opportunities with DoD. PTACs provide assistance to over 50,000 small businesses each year, including new entrants. They help small businesses identify opportunities to do business with DoD and perform on contracts as prime and subcontractors. DoD is increasing the connectivity and collaboration of these PTACs with DoD's contracting workforce, small business professionals, and small business programs to make it easier for small businesses to find opportunities in the defense marketplace. In addition to this, DoD provides cybersecurity resources to small businesses through Project Spectrum regarding DoD's cybersecurity requirements, including self-assessments of readiness to do business with DoD.

Leveraging Small Business Programs to Grow the Industrial Base

DoD's small business programs play an instrumental role in diversifying the defense supply chain and bringing new entrants, specifically from underserved socio-economic groups, into the defense marketplace. In FY 2021, the President's budget restored funding for the Mentor Protégé Program (MPP), tying it to Build Back Better and leveraging the program to bring small businesses from underserved communities and new entrants into the defense supply chain through agreements through which mentor firms provide business development assistance to small business protégé firms. Despite bipartisan congressional support for the program, the funding for this program was eliminated as a part of the defense-wide review in 2020, which led to a decrease in socio-economic firms participating in MPP and in defense procurements. MPP is the only funded business development assistance program in the federal government and each year, small businesses that participated in this program as protégés contribute between \$3–\$4 billion in work to support the defense mission. DoD is expanding MPP into more defense agencies and taking steps to decrease the timeline to secure an MPP agreement.

DoD program managers have the autonomy to deploy acquisition strategies to stimulate competition. Programs like the SBIR and STTR attract small businesses to develop new or improved technologies. Such programs stimulate technological innovation in the DIB and encourage new entrants and disruptors to enter markets. A priority for DoD is working to strengthen its partnerships with small businesses and make it easier for them to access the SBIR/STTR programs, which receive nearly \$2 billion annually in DoD investment.

The benefits of this investment, for DoD and for small businesses, are clear. A recent study of the SBIR/STTR programs found that DoD achieved a 22-to-1 return on investment in small business R&D over the last 23 years and generated \$347 billion in total economic output nationwide.

A top priority for DoD is improving award timelines for the Phase I SBIR and STTR Programs. By making faster SBIR/STTR awards to small businesses both for initial awards and for subsequent Phase II and Phase III commercialization awards, DoD can bring new entrants into the national security and technology industrial base and enable current SBIR/STTR awardees to more rapidly mature technologies to support mission requirements. DoD significantly improved on meeting the required 90-day notification to small businesses of decision to award as well as the Small Business Administration's recommended contract award times of 180 days from the close of the initial SBIR/STTR solicitation. According to the results from recent reports from the Government Accountability Office (GAO), DoD observed a 16% and 30% improvement in selection notification and award timeliness, respectively. This improvement provides more predictable and rapid timelines to get awards on contract to support small business growth and foreseeable cash flow. In addition, the military services have established their own pilot programs to address timeliness in innovative ways to achieve the same improvements. DoD is also increasing usage of out-of-cycle topics, which are SBIR solicitations issued outside of the regular three SBIR solicitations per year. This creates more opportunities year-round for small businesses to participate in SBIR competitions.

To make the positive changes systemic across the Department, DoD also reestablished the DoD SBIR/STTR Contracting Officers Working Group in 2020 and hosts monthly DoD SBIR/STTR Program Managers Meetings to share best practices to foster improvements in the quality and

timeliness of awards. DoD is also enhancing training for personnel in the acquisition workforce to increase understanding of SBIR/STTR programs and the challenges faced by SBIR/STTR awardees. All these program management and training initiatives enable stakeholders who are key to the SBIR/STTR acquisition process to improve processes and assist industry partners to successfully compete and win requirements in support of the DoD mission, while growing their capacity and capability.

To grow and support the network of science and technologies in support of the DoD mission, DoD implemented the OUSD Transitions SBIR Technologies (OTST) program in June 2020. The OTST program assists in accelerating the transition of SBIR- and STTR-funded technologies into defense programs. It focuses on systems developed, acquired, and maintained for the warfighter and to bridge the time gap between R&D awards and contracting delays that lead to companies falling into the valley of death¹⁵ between an award, such as SBIR, and transition into a program. To date, 46 SBIR/STTR Phase II projects have been approved for additional funding and \$62.2 million been awarded to small business.

Additionally, to attract new entrants into the defense marketplace, leverage commercial technology, and utilize innovations from the nation's entrepreneurs, it is vital for DoD to use new methods to engage and do business with commercial companies. To that end, DoD's National Security Innovation Network hosts hackathons, pitch events, and prize challenges that link academia, entrepreneurs, and inventors to DoD mission requirements. This national network of innovators is an important place to get engaged in the defense marketplace for new entrants. Additionally, DoD's Defense Innovation Unit also leverages OT authorities to contract rapidly with commercial companies to prototype commercial or dual-use technologies for defense requirements. These efforts all leverage existing programs within DoD to increase competition within the DIB.

Reducing Barriers to Entry to Support Competition

Small businesses also face significant barriers to entry in doing business with DoD. To this end, DoD issued a notice in the Federal Register soliciting feedback from industry on barriers to entry to inform the development of DoD's Small Business Strategy and is working to ensure that regulation and policy do not unduly burden small businesses. As a part of this process, DoD supported an interagency effort with the White House, the Office of Management and Budget (OMB) and the Small Business Administration to implement meaningful reforms to category management that will increase the ability of certified small businesses, such as Small Disadvantaged Businesses, Women-Owned Small Businesses, Service-Disabled Veteran-Owned Small Businesses, to compete for federal government contracts and for federal agencies to receive Tier II Category Management credit towards OMB-established Category Management goals. This interagency effort will also create more opportunities annually for small businesses to onboard onto contract vehicles and compete for contract awards. Additionally, DoD is working within the interagency to develop a definition of new entrants, to allow it to benchmark against and track the inclusion of new entrants in the federal marketplace. DoD will also continue to implement management practices that are focused on raising the visibility of small business

¹⁵ The valley of death is a term frequently used among venture capitalists to describe the period in the life of a startup between when it begins operations and when it begins to generate revenue. During this period, the company uses up initial equity and must begin to generate enough revenue to become self-sustainable.

capabilities across DoD and holding Senior Executives accountable for small business objectives in their annual performance planning. These efforts are aimed at reversing the decline in the small business supplier base and increasing competition, specifically through small business set-asides.

Section 3: Defense Industry Outlook—Sectors Where Insufficient Capacity and Competition is a Concern

To effectively and efficiently utilize resources, DoD examined the state of competition in five critical focus areas: castings and forgings, missiles and munitions, energy storage and batteries, strategic and critical materials, and microelectronics. DoD further identified the health of the small business DIB (discussed in the previous section) and workforce (discussed below) as critical strategic enablers across all prioritized sectors, along with cyber posture, interoperability, and manufacturing.

Recommendations addressing vulnerabilities in these sectors and enablers are further detailed in the Department’s report on Executive Order 14017, *America’s Supply Chains*.

Workforce Constraints and Shortfalls

In each of the below sectors, workforce constraints and shortfalls are an area of concern. In fact, the growing shortfall of middle- and highly-skilled workers is a global manufacturing concern.¹⁶ In addition to the overall shortage of workers, business consolidation and reduced competition in defense manufacturing frustrates DoD’s ability to compete in the labor market, both for broadly needed manufacturing skills and for workers with critical defense specialty skills. Fluctuations in defense contracts increase the risk that individual companies will lose production work and be unable to retain their workers on defense production lines. Once these highly skilled workers move out of defense supply chains, “they are difficult to recruit back and more expensive to retrain.”¹⁷ The defense manufacturing sector comprises primarily small and medium manufacturers (SMMs), so any constriction of this sector affects these businesses the most. As a result, SMMs die off as their capabilities and workforces cannot compete successfully for new work.

To improve and maintain competitive advantage as defense needs and technologies change, manufacturers must retain workers with defense-specific skills, upskill their workforces when needed, and access the skilled workers to modernize their production capabilities. Today, DoD and other stakeholders are working to reconnect the workforce development (training and education) ecosystem, which includes students, to defense industry needs. These efforts include helping to recruit and connect students and adult learners to defense manufacturing employment opportunities and incentives to develop the skill sets essential to defense supply chains. These efforts will improve defense manufacturers’ access to skilled workers and their ability to respond to emerging defense business opportunities.

¹⁶ Korn-Ferry, “Future of Work: The Global Talent Crunch, April 26, 2020.

¹⁷ Eaglen, Mackenzie and Sayers, Eric, “Maintaining the Superiority of America’s Defense Industrial Base,” The Heritage Foundation, May 22, 2009.

Priority Industrial Base Sectors¹⁸

Castings and Forgings

Cast and forged products are critical to defense and are used in almost all platforms, most subcomponents, and machine tools and other production equipment. Leading sector companies take advantage of China's low labor costs and lax environmental regulations to compete on price. Like many other manufacturing sectors, this area has been subject to industrial espionage and state-backed adversarial capital pressures. DoD casting and forging business can often be unattractive to firms and investment capital providers because DoD often orders in small quantities but frequently has highly specialized requirements that most commercial firms cannot afford to equip themselves to fulfill.

In the domestic market, these factors have combined to impede innovative product and process development for defense, including the incorporation of new manufacturing technologies. They have also produced loss of technical expertise in the U.S. castings and forgings workforce, which has also long lacked representative diversity.

Barriers to Competition

Low margins, low and unpredictable demand, and little incentive to add new capabilities: The castings and forgings sector is mature, capital-intensive, and fiercely competitive on price, but access to capital can be poor. DoD often does not order enough or with sufficient regularity to supply a stable base for business. Margins are often too tight for firms to produce the capital required to add new capabilities, such as working with new material and larger facilities.

Onerous business processes and regulations, paired with substandard technical data: DoD's requirements development, acquisition, and sustainment processes form a long, complex lifecycle and can require provision of extensive sets of data. Businesses perceive DoD policies on accounting requirements, cybersecurity, and other business needs as imposing uncompensated additional costs compared to more profitable commercial procurement opportunities. Outdated policies make many DoD programs unable to furnish the industry-standard 3D technical data required by modern production processes. Translating from 2D paper blueprints and outdated or error-prone files imposes unacceptable costs and risks on casting and forging suppliers.

Unique materials and high quality standards: Many DoD programs use materials or have technical needs that require production processes, equipment, facilities, and specifications far beyond those of more numerous commercial products. However, the DoD market for these materials is too small to justify the cost and risk of adding capabilities or sustaining a new, specialty firm.

Overall Impact

The impact of competition in this sector has been mixed. For DoD needs that are well-aligned with commercial mass production (i.e., similar to commodity products), competition has spurred some innovation and helped DoD control prices to some extent by supporting a larger supplier

¹⁸ These sectors were established as priority areas by the Department of Defense through its response to President Biden's Executive Order 14017 on America's Supply Chains. For its one-year report on its implementation of that executive order, the Department provides the national security rationale for this prioritization.

base. However, when DoD requirements are not so aligned or when required volumes are too small, the pool of potential suppliers has often been far too small to support meaningful competition. This has presented DoD with three options: live without the product(s), provide direct support to keep relevant commercial firms in the market (via Defense Production Act Title III investments), or develop the needed production capabilities in the organic industrial base. The first option can result in mission failure. The other two options often produce limited capabilities with less flexibility and higher overall costs.

Well-intended efforts to spur competition can also produce unintended effects, especially at DIB tiers below the defense primes. Such effects reported by industry include avoidable production delays, stifled innovation, product quality issues, and loss of beneficial long-term supplier relationships due to supplier perceptions of a less-than-level playing field. Ultimately, some firms simply choose to exit the defense market.

As a result, DoD is largely limited to the same OEMs supplemented and served by a constantly shrinking set of small job shop suppliers making razor-thin margins, one contract loss away from bankruptcy. This situation can result in loss of specialty capability, especially as older workers with extensive tacit knowledge retire.

Missiles and Munitions

Barriers to Competition

The missiles and munitions (M&M) sector has trended toward consolidation, with 30 prime contractors in this sector three decades ago, but only seven today. Each M&A case should be reviewed carefully for negative effects on competition. The consolidation trend is even more pronounced in the hypersonic weapon systems sector, which currently has only one prime contractor.

The growing pressure on defense budgets to reduce costs and spending has negative effects on munitions programs—including service cuts and congressional program reductions. While the budgets for munitions have not returned to their 2015 low, the services tend to flatten M&M procurements or cyclically push procurements into the out year. As commodity costs grow, these factors drive suppliers to exit the market rather than join it, such as automation solutions companies pivoting away from lower-margin defense programs.

M&M is a market with few competitors, all of whom are large companies with established brand identities and strong holds on cumulative experience, proprietary designs, and technology. Competition in the sector is mainly derived from these few companies bidding on new projects. The costs to enter the M&M market are higher than other sectors due to the nature of weapon systems—particularly as safety requirements add additional layers to the design of equipment and/or facilities. For example, any company storing or using energetic materials requires larger property investments, due to quantity-distance limitations and explosion-proofing of equipment and buildings. These additional costs, while necessary and appropriate, can heavily burden any entrant into the market.

Overall Impact

As DoD looks to expand its missile capacity to deter adversaries, the impact of consolidation on DoD programs will play a role. For this industrial base sector, the impacts are similar to those

defined throughout this report: reduced competition, increased costs, and potential supply chain risks due to capacity shortfalls. One area within the M&M (and aircraft) sector where attention should be paid in the coming decade is hypersonic technologies. Within this sector, many primes, first-tier subcontractors, and first-tier material suppliers are positioning themselves to acquire lower-tiered hypersonic contractors and material suppliers.¹⁹ This vertical integration will likely lead to reduced competition and may eliminate it altogether. As the demand for hypersonic weapons grows, so too will the need for specialized manufacturers and suppliers. However, these small and nascent companies are at risk of acquisition from the major primes and subcontractors. Acquisition of these specialized hypersonic niche contractors (especially at this early stage of hypersonic technology and hypersonic missile development) will effectively prevent any other company from entering the market, thereby leading to reduced or limited competition, and capacity issues in the future. When competition is no longer a variable for a company the only other acquisition approach may be sole-source contracting. This was most recently demonstrated when Boeing dropped out of the Ground Based Strategic Deterrent (GBSD) engineering and manufacturing development phase competition saying “the current acquisition approach does not provide a level playing field for fair competition”²⁰, resulting in Northrop Grumman receiving a sole-source contract.

Energy Storage and Batteries

Barriers to Competition

Adversarial efforts to capture the battery value chain have limited competition and led to consolidation in the advanced battery sector. This consolidation has led to the loss of domestic sources of raw materials and battery components; consequently, DoD relies on foreign-produced batteries for many of its military capabilities. The People’s Republic of China leverages its disregard for worker safety, environmental impact, and chemical pollution to lower its costs and dominates the battery cell market with approximately 80% of the material sources, processing materials essential for lithium batteries, including lithium, graphite, cobalt, and battery-grade nickel. These sole sources and reliance on foreign-produced batteries reduce competition and result in U.S. vulnerabilities.

The U.S. industrial base for battery component manufacturing capacity is limited and requires major capital expenditures and time to compete. The U.S. doesn’t manufacture cathodes or electrolyte domestically in a scale compared to demand. Large-scale commercial batteries and specialty batteries for DoD face major challenges to build sufficient capacity. Specialty DoD-only batteries have very low demand. Production requires specialty skill sets, reliable production processes, capital, and a history of success to compete for DoD business. DoD systems, developed years in advance of volume production, must have sufficient income to survive the funding gap as well as long investment recovery periods. This has left some battery manufacturers to bear the design and qualification costs prior to production.

In any acquisition where the requirement is clearly definable and the risk the product or service will not meet requirements is low, cost or price may play a dominant role in the selection process. Where DoD does not also consider supply chain risk and logistics security, a low-cost

¹⁹ LM acquired i3, <https://news.lockheedmartin.com/2020-10-09-Lockheed-Martin-to-Acquire-i3-Hypersonics-Portfolio>.

²⁰ Boeing Drops Out of GBSD Competition, <https://theelectricgf.com/2019/07/25/boeing-drops-out-of-gbsd-competition-to-replace-icbms/>.

option may add risk, especially when those low-cost options are from adversary nations. Therefore, the lowest-cost suppliers can become the DoD supplier, even for critical weapon systems. Additionally, a lack of competition on some materials and components at best performance levels occurs because a company has an IP lock on its production. Without policies that incentivize robust and high-quality supply chains, securing low-cost components will continue to be a challenge.

The lithium-ion sector includes a high cost of capitalization for production scale to achieve competitive economy of scale. Lithium-ion batteries can be produced by hand but this process results in a poor quality and more expensive product. For specialty DoD-only batteries, barriers to market entry include low demand, lack of specialty skill sets, and the need for reliable production processes. These elements require capital and a history of success—challenging barriers for new entrants to overcome. Other barriers include a long pay-back period on investments, which can deter market entry even if a new entrant can capitalize the necessary facility and production equipment. Some battery manufacturers must bear the design and qualification costs prior to production.

Additional challenges in this sector are:

- DoD’s small proportion of the customer base for energy storage limits its influence on the market.
- In the energy storage space, secure access to supply chains is needed for key capabilities and to support distributed operations in contested environments.
- Carbon/graphite is the anode structure for lithium-ion batteries. However, in terms of market share, the U.S. has some synthetic graphite production capability and is seeking more, but no defense battery producer uses only synthetic graphite.
- China holds a significant share of the market in cobalt processing (82%) and manganese processing (93%). Manganese and cobalt are necessary in producing lithium-ion cathode material.

Overall Impact

The Department is often dependent on commercial battery technologies for meeting National Defense Strategy objectives. China’s dominance in minerals, materials, and cells globally presents supply chain risks. This trend will continue without a collective response as outlined in the goals within the National Blueprint for Lithium Batteries (2021-2030)²¹, and the recommendations outlined in the report covering the 100-Day Reviews under Executive Order 14017.²² The five goals within the National Blueprint for Lithium Batteries and the recommendations outlined in the 100-Day Reviews focus on increasing investment in the upstream mining, materials processing, and battery precursor materials production, as well as supporting downstream cell and pack production. Both documents highlighted the need to

²¹ National Blueprint for Lithium Batteries, U.S. Department of Energy, June 2021, [https://www.energy.gov/sites/default/files/2021-06/FCAB National Blueprint Lithium Batteries 0621_0.pdf](https://www.energy.gov/sites/default/files/2021-06/FCAB%20National%20Blueprint%20Lithium%20Batteries%200621_0.pdf).

²² Building Resilient Supply Chains, Revitalizing American Manufacturing, and Fostering Broad-Based Growth, 100-Day Reviews under Executive Order 14017, June 2021, <https://www.whitehouse.gov/wp-content/uploads/2021/06/100-day-supply-chain-review-report.pdf>.

coordinate closely with industry on the development of a skilled, sufficient workforce and maintaining technological dominance through continued R&D investment.

In line with these goals and recommendations, the Department advocates for a whole-of-government approach to address challenges within this sector, coupled with the resources needed to take action to reverse the erosion of domestic DIB battery capabilities and capacity.

Strategic and Critical Materials

Barriers to Competition

Competition in the critical materials sector is distorted by political intervention and unfair trade practices in adversary nations. These factors result in significant challenges for the survival of domestic and allied manufacturers in commercial markets, where price drives demand. Domestic and allied manufacturers often exit the business, leaving single-source suppliers in adversary nations producing specialty metal alloys, rare earth elements, and critical chemicals.

Further, weak environmental and labor regulations, as well as lax enforcement of risk such as forced labor, provide unfair cost advantages to companies operating in adversary nations. Such activities artificially decrease the fair market price for strategic and critical materials and undermine the competitiveness of U.S. and allied producers.

Critical materials manufacturing is capital- and time-intensive. Mining and processing concerns are risk-averse while capital recovery times are long. Furthermore, pricing of mined material is inelastic while downstream manufacturers more rapidly change suppliers and product formulations to obtain the lowest cost source. Companies are disincentivized from spending money on a project without surety of a profit in the long run. Changing the structure of the supply chain for these materials is difficult without government incentives and partnerships with the private sector.

Finally, the U.S. depends heavily on foreign sources for critical chemicals in its weapon systems. The COVID-19 pandemic showcased the vulnerability of supply chains to interruption, whether by force majeure or design. These critical chemicals include inorganic salts as well as environmentally challenging materials. The U.S. market for critical chemicals focuses on agricultural or industrial use, which have higher volumes and less stringent requirements than materials for military applications.

Overall Impact

The U.S. must ensure a domestic supply of the critical materials essential to U.S. defense programs, especially key munitions. Policy interventions should be tailored to the unique market failures of a given strategic and critical material market, with a strong emphasis on partnerships with the private sector and accelerating the development of diversified and reliable sources of supply. The U.S. must consider an all-of-the-above approach, including high-risk research for advanced production processes and equipment, facilitating business-to-business ties within the industrial base and with U.S. allies, and, as appropriate, bespoke trade remedies.

Microelectronics

Barriers to Competition

There are a series of challenges for microelectronics (ME):

- DoD has limited market influence in the ME sector, holding approximately 1% of the customer base. This inhibits competition, since very few ME companies are willing to engage with low-volume customers.
- The offshoring of ME manufacturing reduces domestic competition. U.S. domestic manufacturing is expected to decline from 12 percent to 10 percent by 2030. Factors that contribute to offshoring include exorbitant R&D costs associated with advanced semiconductor technology and the large capital investment required to build and operate semiconductor fabrication facilities.
- Domestic semiconductor manufacturers, structured to compete in a fair market for profit, are increasingly forced into a one-sided competition with non-market competitors. This situation reduces profit for the domestic manufacturers, translating to less investment in R&D. Less investment in R&D reduces innovation, impacting long-term competitiveness and reducing employment opportunities domestically.
- Governments in Asia offered tax breaks to U.S. industries to relocate as incoming industry offered employment and technology transfer to their growing populations. The countries offered a large, low-wage workforce, affordable land, and tax incentives to become an economically fertile ground for the U.S. and other foreign investment.
- Secure access to ME is vital to maintaining national and economic security. Many large ME manufacturers are not willing to adopt DoD assurance and security protocols, which reduces the number of manufacturers engaged in supplying DoD ME products.
- DoD imposes unique requirements and associated low volumes, disincentivizing vendors to engage in manufacture of DoD ME products.
- China has pledged to invest over \$250 billion in ME. Much of this investment is targeted at expanding capacity to achieve semiconductor manufacturing independence, without consideration for market conditions, such as excessive inventory resulting from excess manufacturing capacity. This may reduce profit margins of domestic manufacturers who compete with Chinese firms on a cost basis.

Overall Impact

Because of targeted incentives and heavy government subsidies by countries in the Pacific Rim, primarily China, U.S. manufacturers have lost much of their capability to produce ME, remaining active only in the design phase. As a result, DoD has found it challenging to secure technology for state-of-the-art ME and to sustain domestic production for legacy ME critical to U.S. military systems. Irrespective of the U.S. longstanding record of sustained innovation, countering the efforts of adversary nations and market forces to regain the domestic capacity to meet national demand for ME and reduce reliance on Pacific Rim will take a whole-of-government response.

Conclusion

Maintaining a competitive DIB is vital to our national security interests. Major consolidations in the mid-1990s significantly reduced competition for weapons programs, with the total number of U.S.-based prime contractors declining from 51 in 1993 to 5 in 2000 [Figure 2]. The landscape

has largely remained unchanged since then, but some moderately concentrated sectors, like aircraft and missiles, have seen increased deal activity resulting in further risk of single/sole sourcing for key capabilities. For example, recent consolidation in the solid rocket motors sector has resulted in only two domestic suppliers [Figure 3]. In the last five years, smaller deals have increased due to primes vertically consolidating the industrial base, sub-prime suppliers acquiring horizontally, and the entry of private equity firms performing roll ups.

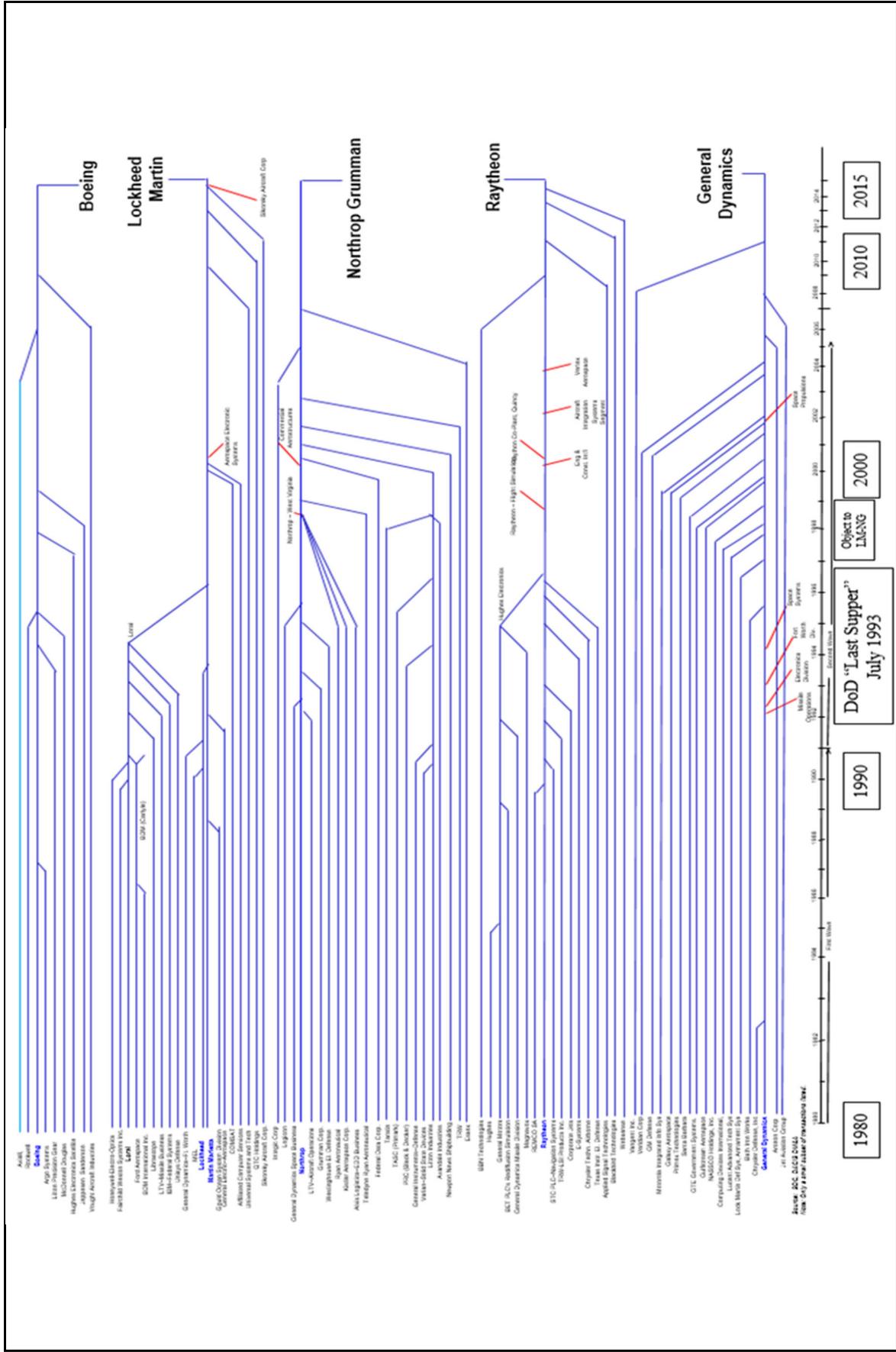


Figure 2: From 1980 to 2015, the defense sector has seen significant consolidation—Illustrative

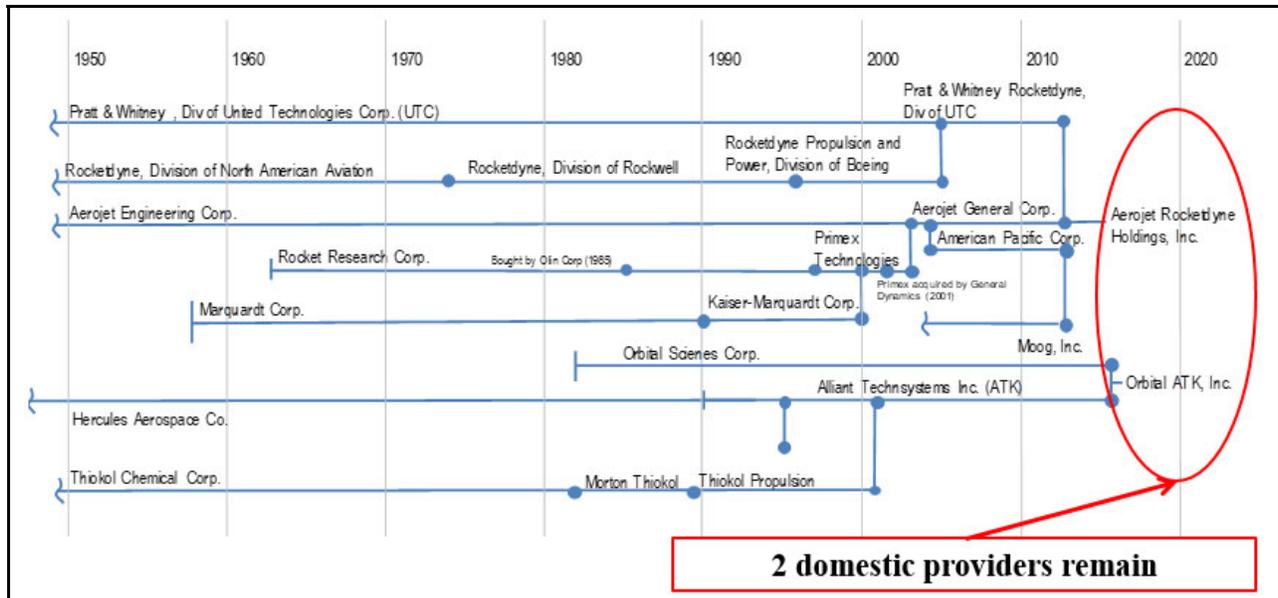


Figure 3: From 1950 to 2020, solid rocket motor production has consolidated

In mature markets, redundancies and inefficiencies can be harbingers of value drain, and the emergence of dominant players within an industry can have positive impacts on customers. In particular, companies that can develop economies of scale or scope and mature learning curves to drive greater efficiencies can deliver lower costs and better innovation for customers. Although consolidation has, in some cases, led to improvements in corporate efficiency, product quality, or internal costs, too much market concentration can negatively impact competition by providing the remaining companies with greater market power to potentially foreclose on competitors, reduce customer choices, limit innovation, and charge higher prices to DoD.²³

To achieve the goal of maximizing competition, DoD competes every contract action to fulfill Department requirements for products and services, where practicable, through continued application of the Competition in Contracting Act. As highlighted in this report, when measured by individual contract action, over 90% of actions are competed. DoD has sufficient statutory and regulatory authorities to seek competition in its solicitation and contracting processes.

However, DoD's ability to expand competition in procurements is more reliant on addressing industry-wide challenges, such as industry consolidation and limited domestic capacity due to commercial or economic pressures. Further, competition for sustainment contracts is hampered by DoD's ability to secure the necessary data rights, technical data, and computer software; the impacts of aging weapon systems and obsolete parts; and the drive to leverage commercial items and commercial or commercial-derivative technologies. These challenges, discovered and documented in market research, inform the resulting system's acquisition strategy and determine the depth of competition achievable over the life of any major system.

Despite these sizable challenges, DoD is promoting competition by seeking new entrants, attracting non-traditional defense contractors, and growing capacity in its existing vendor base.

²³ Nayantara Hensel, 2010. "Can Industry Consolidation Lead to Greater Efficiencies? Evidence from the U.S. Defense Industry," Business Economics, Palgrave Macmillan; National Association for Business Economics, vol. 45(3), pp. 187-203, July.

The strategy includes careful review of potential M&A, new IP policy, IP workforce training, use of innovative acquisition processes (e.g., OTs and CSOs), and small business outreach and streamlining of R&D programs to support small businesses.

DoD recognizes a whole-of-government effort is needed to address the economic and commercial market pressures that continue to drive offshoring and challenge the deliberate efforts by adversary nations to grow and deny these technologies and materials to the U.S. and its allies. DoD offers a series of actions to grow the domestic capacity and capability for these vital technologies and materials, contributing to greater national and economic security. DoD's actions will promote greater competition while also supporting and growing a workforce that will underpin and deliver these important technologies and materials.

Department Actions to Achieve the Goals of the Executive Order

The Department will confront the challenges posed by industry consolidation and work to ensure sufficient domestic capacity and capability in priority industrial base sectors. These actions include:

- Given the extent of consolidation of key industries over the last decade, DoD will assess its approach to evaluating vertical and horizontal mergers, with adequate attention to risks to national security.
- DoD will work with interagency colleagues at the Department of Justice and Federal Trade Commission to further examine the impact of consolidation on the functioning of the defense market.
- DoD will implement the interagency recommendations outlined in Executive Order 14017, *America's Supply Chains*, focused on the five priority sectors of the DIB: castings and forgings, missiles and munitions, energy storage and batteries, strategic and critical materials, and microelectronics. This includes developing alternatives to the use of strategic and critical minerals to increase supply resilience for defense programs and national security, and to reinvigorate the supply chain.
- DoD will support workforce development efforts in the manufacturing and technical trades to sustain defense specific skills needed to develop, field, and support DoD systems and equipment.

The Department is also taking action to further competition within its contracting processes, procedures, guidance, regulations, and the training of its workforce. The efforts are designed to use flexible authorities to attract non-traditional contractors, new entrants, and build back the small business vendor base. Given the importance and challenges to acquiring the IP and associated rights to support greater competition throughout a system's lifecycle, the Department outlines a series of ongoing efforts to overcome those challenges. These include:

- Leverage and promote appropriate use of OT authority to continue to attract non-traditional and new entrants to the DIB. Provide revised guidance to ensure the effective, efficient, and transparent use of these OT authorities for research, prototyping, and production.

- Expand appropriate use of CSOs to rapidly apply leading-edge industry solutions to operational and R&D challenges, which also attract non-traditional vendors and new entrants to the DIB.
- With an eye to avoiding anticompetitive conduct contrary to DoD's interests, complete the current public rulemaking activities related to data rights statutory, policy, and best-practice changes covering issues such as IP valuation, negotiation of special licenses, MOSA, and data rights in SBIR and STTR programs.
- Complete and publish the forthcoming *Intellectual Property: A Strategic and Tactical Guidebook* (IP Guide) to support and explain legal and practical challenges to acquiring the IP and associated IP rights to support the DoD mission, especially for developing, fielding, and sustaining weapon systems, including maintenance and repair.
- Leverage the IP Guide and complete workforce credential training to address IP challenges to secure the IP rights and technical data needed to drive increased competition throughout the lifecycle of major systems.
- Implement DoD's forthcoming Small Business Strategy to promote a strong, dynamic, and robust small business industrial base by reducing barriers to entry, increasing small business set-aside competitions, and leveraging small business programs to grow the small business industrial base.