# How to On-Shore Critical Semiconductor Production, Secure the Supply Chain, and Provide Access for the Industrial Base

White Paper

Electronics Division

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# Foreword

This White Paper addresses US Government and Semiconductor Industry shared interest to establish a robust, on-shore, supply chain. Findings include increased flexibility in acquisition and commercialization of Government and Industry critical technologies. Technology adjacency should be fostered to share, as well as cover, the costs associated with on-shoring. Rapid update of policies and closely coordinated actions to account for global realities are recommended to mitigate and reverse off-shoring trends. Holistic demand signals and improved industry standards are necessary to optimize the domestic ecosystem.

## Paper Disposition

This paper will be made available on the National Defense Industrial Association website as a reference resource: [https://www.ndia.org/divisions/electronics/resources](https://www.ndia.org/divisions/electronics/resources).



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Members of the Electronics Division reviewed this paper prior to its publication. For more information about the Electronics Division, including a list of upcoming events, please visit NDIA.org/Divisions/electronics.

 

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# Executive Summary

## Overview

The NDIA Electronics Division, Defense Industrial Base and Policy subcommittee solicited feedback from our traditional and non-traditional defense industry members based on a set of questions developed from recent engagements with the US Government (USG) Office of the Secretary of Defense (OSD) Microelectronics Stakeholders and Congressional Staffers. These included Ms. Nicole Petta (Principal Director for Microelectronics at Research & Engineering (R&E)), Dr. Christine Michienzi (Chief Technology Officer for Industrial Policy at Acquisition & Sustainment ), Dr. Matthew Kay (Air Force Research Lab Trusted & Assured Microelectronics Project Lead, Strategic Rad Hard Electronics Council Executive Secretariat, OUSD R&E), Jon Cardinal (Office of Senator Chuck Schumer), Flynn Rico-Johnson (Office of Congresswoman Doris Matsui), Claire Sanderson (Office of Senator John Cornyn), and others. Several key U.S. Government (USG or Government) interests and opportunities for industry members to provide feedback were identified. These include improving commercial industry engagements, leveraging Public-Private Partnerships (PPP), and supporting the simplification of DoD Procurement standards and metrics. Actions based on the American Foundries Act[1], CHIPS For America Act[2] and 2021 National Defense Authorization Act[3] were also discussed. These bills represent a watershed moment for USG investments in strengthening domestic Microelectronics capabilities and supply chains with potential funding levels in the tens of billions of dollars.

The USG and NDIA Electronics Division members recognize that the significant gap between on and off-shore U.S. Microelectronics capabilities, particularly in key areas, such as leading edge lithographic node semiconductor fabrication, packaging and test capabilities, present severe risks to U.S. national security and competitiveness. In addition, the coronavirus pandemic has further exposed existing grave supply chain weaknesses, including heavy U.S. reliance on high risk, off-shore sources for critical parts and materials. The major role that adversarial foreign nations, in particular China, play in our critical supply chains is in direct conflict with domestic critical infrastructure security, economic interests and U.S. national security.

## Major Recommendations

To address these challenges, we propose a close collaboration among Government and commercial industry partners to address the following recommendations:

- Take concrete steps to better align USG business and funding practices with those of commercial Industry
- Create processes to consolidate and forecast USG full lifecycle demand and technology needs at least semi-annually to better align with commercial industry planning cycles
- Identify ways that USG Federal Acquisition Regulations, DoD procurement standards, logistics, export control, security requirements, etc. can be simplified without legislative action; assist the Executive Branch in making these changes within six months
- Achieve comprehensive Export Control reform

 

- Develop clear and well-defined supply chain protection and security standards
- Restrict USG contract awards to trusted and assured on-shore supply chains, inclusive of sub-tiers, when available
- Improve intellectual property ownership and use rights to better incent commercial industry to partner with the Government for robust IP portfolio development, while addressing USG needs for IP protection for critical mission application
- Implement procurement standards and metrics that define targeted security requirements and drive actions to incent adjacent commercial market demands and require secure products for use in critical infrastructure, AI, 5G, and related markets for use in the United States
- Expand existing and develop new, pre-competitive Public-Private Partnership organizations in workforce development, R&D, design, fabrication, packaging, and test infrastructure involving both academia and industry (small and large)
- Fully leverage existing onshore assets and take better advantage of current infrastructure and workforce to optimize investment outcome
- Identify and prioritize semiconductor and advanced packaging, assembly and test needs, gaps, and investments across the lifecycle for all semiconductor processes and nodes
- Ensure that the defense industrial base is represented on all advisory panels and technology councils mentioned in the CHIPS for America Act, The American Foundries Act, and the FY2021 NDAA.
- Explore opportunities to collaborate with allied nations in semiconductor R&D, design, and manufacturing to fill critical gaps
- Increase coordination of semiconductor R&D and manufacturing programs conducted across various government agencies
- Build on ***The Decadal Plan for Semiconductors***[4], which outlines semiconductor research priorities across seismic shifts and recommends an additional federal investment of $3.4 billion annually across these five areas. The interim report was released in October, and the full report is scheduled to be released soon.
- Build a portfolio strategy for ensuring the integrity of DoD system custom ICs that includes appropriate use of the Trusted Supplier Program and Quantifiable Assurance techniques
- Fully fund CHIPS/AFA so the legislation may be implemented rapidly

 

# Introduction

Semiconductors have enabled a revolution in commercial products and services since they were introduced in the 1950s. The industry was initially created by USG investment and demand and has matured into a critical part of our commercial economy today as evidenced in the global success of Amazon, Apple, Intel, Qualcomm, and others. Present-day Semiconductor industrial capabilities are key to the domestic economy as well as US military capabilities.

Today, as is the case for most nations, the U.S. is completely dependent on Microelectronics. They underpin every aspect of the U.S. economy, American life and society. The military is fully digitized. Microelectronics are now fundamental in an ever growing range of weapons, transport and operational systems. Malicious tampering or counterfeits in the chips used by the military could have devastating consequences for the U.S. economy and national security.

The critical role of Microelectronics has raised, to the highest level, the importance of U.S. access to a secure and reliable Microelectronics supply chain, including a strong industrial base for on-shore U.S. manufacturing.

Immediate opportunities for increased on-shore commercial Microelectronics capabilities could directly support growth and adoption in key areas including: more secure 5G products, IOT sensors and edge computing, AI-based devices and services, Big Data and Cloud computing. This addresses securing critical national infrastructure like power generation/delivery, and wired communications, directly supportive of 2020 NDAA Sec 224 legislation from congress, "requiring defense Microelectronics products and services meet trusted supply chain and operational security standards"[4].

In this report, key findings and recommendations from NDIA Electronics Division members, based on recent engagements with OSD, are presented. These include strategies for Public-Private Partnerships (PPP) and related recommendations to improve Government engagement with the on-shore semiconductor industrial base. Recommendations for improving DoD Microelectronic procurement standards are also provided. Possible execution strategies relevant to the CHIPS for America, American Foundry Acts as well as the NDAA legislation are also presented. These include shorter term recommendations to mitigate current risks and longer-term ones to strengthen domestic Microelectronics and the U.S. economy as a whole.

## Findings

### Commercial Industry and Government Business Practices are Not Well Aligned and the Government Needs to Adapt

Commercial companies must respond to market dynamics to meet both short and long term business goals, to attract/retain customers, and to expand their portfolios. By contrast, the DoD must develop new capabilities to establish asymmetrical advantage and to counter or defeat potential adversaries. While both approaches respond to outside stimuli, the method and focus of how that is accomplished are different.

USG Microelectronics (including DoD) purchases represent a small portion of the global market demand for Microelectronics, less than one percent, and Defense customers typically need low volumes for highly specialized applications. In contrast, economies of scale enable the commercial Microelectronics industry to afford the immense capital expenses required, and to minimize recurring costs to obtain a return on investment and maximize profit through production volumes. As a result, the Microelectronics industry invests primarily based upon commercial market demand signals.

The timescales for commercial product development are short, measured in months, and necessarily so, as these activities are driven by time to market competition for market share capture. By contrast, Government platforms and their related Microelectronics needs are characterized by very long developmental and operational lifetime scales, measured in years and decades, and phased over multiple fiscal years. This not only results in significantly longer development timelines than realized by commercial Industry, it further exacerbates obsolescence issues for Government Microelectronics.

Government Microelectronics production needs are not sufficiently aggregated or consolidated to provide an overall demand signal which Industry can use to plan and respond to. Government demand is fragmented across many programs and an immensely complex multi-tiered supply chain which is neither centrally managed nor centrally understood. Bulk buys are difficult for many reasons, including Government anti-stockpiling regulations. In addition, there is a risk-averse culture with requirements for competition and transparency in the procurement process. These factors inevitably slow USG actions and create a divergence with commercial practices which leads to non-optimal outcomes for Government programs. Furthermore, sustainment procurements required to maintain Government platforms through very long lifecycles (decades) outlasts commercial market drivers for technology-lifetime viability. As a result, sustainment of Government programs inevitably requires end-of-life procurements which are not typically budgeted for, nor accurately assessed by the Government, for total lifetime quantity needs.

The high refresh rate for commercial electronics devices results in frequent (annual) microelectronic component refresh by manufacturers through rapid adoption of advanced technologies provided by industry. This cycle is driven by consumer demand for ever increasing capabilities in new products. The mobile phone industry is a prime example of such market forces at work. In this case, device refresh rates correlate to Moore's law, and result in commercial market demand for the rapid advancement of semiconductor technologies. This is at direct odds to the long development lead times and long sustainment requirements for Government systems. This further extends the gap in demand signals and highlights why semiconductor technologies are retired at a rate and pace driven by commercial market demands.

Enterprise planning practices between commercial industry and DoD are misaligned. Given the long lead-times required for new Microelectronics technologies to be commercialized, companies establish their Microelectronics research and development roadmaps through tight alignment with long-term budget planning. Management and oversight are traditionally aligned amongst the various commercial business units with a profit first emphasis. This unified approach is necessary to promote long-term business success, to target R&D investments and maximize buying power. In direct contrast, USG programs are by definition compartmented from each other for operational security reasons, and further obfuscated by deep and complex supply chains with little to no central coordination within the Government regarding which Microelectronics components it purchases.

Commercial Microelectronics companies rely on long-term market demand forecasts to determine technology and infrastructure investment opportunities. They consider the return on investment relative to the cost and lead time of new technology development, as well as at-scale manufacturing capitalization costs. This process defines the development budget and the long-term execution activities required to enable technologies, manufacturing capabilities, and sufficient capacity to meet commercial market demand. This process maximizes commercial profit in accordance with market demand signals.

Government budget legislation, funding approval, and appropriation is an annual activity. Funding may be withheld, delayed or adjusted based on short-term, limited perspectives and political factors. This policy and process uncertainty deters smaller sub-tier and non-traditional companies from selling to the Government Microelectronics market, especially those who may not have the means to endure such uncertainty. Those that do engage or support the Government Microelectronics market must plan on these inherent risks through budgeting and resource management measures. This adds to overall Government program costs, which are ultimately passed along to the U.S. taxpayer.

Many non-traditional suppliers are not structured to support complex Government RFI and RFP activities. Exacerbating this, Federal Acquisition Regulations, DoD procurement standards, logistics, export control, security requirements, cyber security requirements, etc. impose further complexity that is not required to sell in commercial markets. The level of effort required to respond to speculative RFI and RFP's are often not worth the potential business return, especially when contrasted with the potential returns of larger and often more lucrative commercial consumer market opportunities, requiring the same level of effort or less. This harms the USG, as well as commercial industry, because it limits the Government's access to the most advanced technologies and systems, and is entirely within the Government's control to resolve.

## Public-Private Partnerships

Public-private partnerships (PPP) have been successfully used as a means to align Government and industry efforts towards common goals, while taking advantage of each organization's unique strengths. The Government can, and should, take a long-term view and support strategic balanced-risk based commercially relevant investments to benefit both Government and industry. Conversely, industry understands how to quickly adopt, develop, and deploy technologies that customers will value, as technology advancements are critical enablers to commercial product success. The prototypical example of a PPP in the Microelectronics area is SEMATECH, which was created to address increasing global semiconductor production tool competition, specifically from Japan, and successfully ran for several decades.

PPPs are a critical tool within the overall framework for addressing competitiveness and national security challenges the faced by Government Microelectronics programs. Such an approach will support the acceleration and availability of Government relevant technology within the framework of dynamic commercial market demands. This same stability can be a benefit for commercial industry. Recent PPP examples are presented below, each of which should be studied such that best practices and successes can be leveraged to inform the much larger PPP investments necessary under CHIPS/AFA.

### Manufacturing USA Institutes

The Manufacturing USA Institutes, established in 2014 to secure U.S. global leadership in advanced manufacturing, provide a model for how Government, industry, both large and small entities, non-profits, and academia can engage in research and development, prototyping, and workforce development efforts in a non-competitive or pre-competitive environment to advance U.S. interests in a specified technology area. For example, the three Microelectronics-focused institutes, AIM Photonics, NextFlex, and PowerAmerica, have leveraged base funding from DoD and DOE to attract cost-sharing contributions from their partners and members, including state governments. All three have increased U.S. manufacturing competitiveness, promoted a robust and sustainable national manufacturing R&D infrastructure, accelerated commercialization, and developed the workforce for emerging integrated photonics, flexible hybrid electronics, and wide-bandgap semiconductors.

In 2019, the 16 Manufacturing Institutes, sponsored by the U.S. Departments of Commerce, Defense, and Energy:

- Conducted over 560 major applied research and development collaboration projects of high priority to broad industry sectors
- Engaged over 1,900 member organizations. Sixty three percent of members are manufacturing firms and 70% of these industry members are small and medium manufacturers, which are key to the U.S. manufacturing supply chain.
- Partnered with educational organizations to teach thousands of workers, students, and educators about advanced manufacturing technologies via workshops, courses, internships, and apprenticeships.
- Leveraged $133M in federal funds to attract $355M in state and private investment, representing a remarkable catalyzing effect of matching investment, reflecting the importance of advanced manufacturing to the future success of state and local economies.

NEW SCIENCE TEAM (NST) Initiative – Enabling the Microelectronics Technology Roadmap for 2025 & beyond

Semiconductor Research Corporation (SRC) in partnership with government, industry, and academia, established a $300M+ initiative dedicated to creating a Smart, Autonomous, Safe, Connected, Efficient, and Affordable future through focused, long-term research that goes beyond traditional scaling.

The unified NST effort consists of two complementary research programs:
- JUMP (Joint University Microelectronics Program)
- NCORE (Nanoelectronics Computing Research)

Research for both JUMP and nCORE commenced in January 2018 and continue for five years, with funding support coming from industry and government partners. Current industry partners that are committed to the effort are IBM Corporation, Northrop Grumman Corporation, Micron Technology, Inc., Intel Corporation, EMD Performance Materials (a Merck KGaA affiliate), Analog Devices Inc., Raytheon Company, Taiwan Semiconductor Manufacturing Company Ltd., Lockheed Martin Corporation, ARM Limited, Samsung Electronics Co., Ltd. and SK hynix Inc. US Government partners currently committed to the effort include Defense Advanced Research Projects Agency (DARPA) for the JUMP program, and National Science Foundation (NSF) and National Institute of Standards and Technology (NIST) for the nCORE program.

Joint University Microelectronics Program (JUMP) - Technology of 2025 and Beyond

This public-private partnership, between DARPA, Industry, and Semiconductor Research Corporation, was launched in 2018 to increase the performance, efficiency, and overall capabilities of commercial and military electronics applications. JUMP provides long-term research focused on high performance, energy efficient Microelectronics for end-to-end sensing and actuation, signal and information processing, communication, computing, and storage solutions that are cost-effective and secure. Funding for JUMP, a five-year sponsored research effort at leading universities, is expected to exceed $150 million, with DARPA providing approximately 40% and consortium industry partners providing approximately 60% of the funding. JUMP is a successor to the DARPA Semiconductor Technology Advanced Research Network (STARnet) program.

Nanoelectronic Computing Research (nCORE) – Basic Research for Novel Computing

This public-private partnership, between NIST, NSF, Industry, and Semiconductor Research Corporation, was launched in 2018. nCORE explores fundamental materials, devices, and interconnect solutions to enable future computing and storage paradigms beyond conventional CMOS, beyond von Neumann architecture, or beyond classical information processing/storage.

Scalable Asymmetric Lifecycle Engagement (SCALE) Microelectronics Workforce

The Scalable Asymmetric Lifecycle Engagement (SCALE) Microelectronics Workforce Public-Private-Academic Partnership was established by the Naval Surface Warfare Center (Crane, IN) as a nationally coordinated network of partners, regionally executed, to create an asymmetric workforce advantage in Microelectronics. Led by Purdue University, the PPP is designed to train students and support faculty through courses, projects, research, and internships in specific technical areas including:

- Radiation-hardening (Vanderbilt, Air Force Institute of Technology, St. Louis University, Brigham Young University, Arizona State University, Georgia Tech, Purdue University)
- Heterogeneous integration (Purdue University, Georgia Tech, SUNY-Binghamton, Arizona State University)
- System-on-a-Chip (Ohio State University, Georgia Tech, Purdue University, UC-Berkeley)

The SCALE model is applicable to multiple universities and replicable to additional topics important to the Department of Defense, Government, and Defense Industrial Base. SCALE aims to address factors that impact transition to DIB STEM careers; dedication/commitment to the opportunities and DIB-relevant knowledge, skills, and abilities. SCALE was developed using Social Cognitive Career Theory (SCCT), a research-based approach, to identify what factors influence the choice of students to go into these opportunities. Many of the courses include applied elements to ensure contextualization of the material in these technical areas.

## DoD Microelectronic Procurement Standards and Metrics

Current acquisition practices fail to fully address a number of important technical, policy, and business issues. Presently, there is no whole of Government approach to address requirements upon industry. Government programs that could benefit from mutual coordination (such as aggregated demand for the same technology from industry) are largely executed individually by various departments, agencies, and DIB performers, over long time spans with poor total demand definition. Where centralizing requirements are not established, industry is unable to view aggregated Government demand, resulting in reduced or lack of interest in each individual opportunity. The result is reduced technology availability to the Government, and for those technologies supported, higher program costs (which are ultimately born by the taxpayer) and slower overall progress. As the Government looks to address central planning, successes from the aggregation of demand through the Trusted Foundry program should be studied and scaled to the broader Government use case.

 

Government Microelectronics programs don't adequately address obsolescence concerns, and often assume that if a commercial semiconductor technology is of enough important to Government interests, that a solution will be created at the future time of need. Traditional mechanisms include negotiating and funding for Government license rights to subject technologies for practice at other foundries, including Government foundries. More effective approaches can be achieved through optimized, whole of Government portfolio, technology selection, and combined with whole of government demand, negotiating with industry for extended technology availability. Coupled with lifetime buys and planned technology migrations for long lived Government Microelectronics programs, more effective and pro-actively achieved outcomes can be realized.

DoD standards such as DoDi 5200.44[5] lack requirement details and are subject to interpretation. Since these are DoD specific, they lack applicability for industry to leverage for commercial markets. As a result, industry adoption has been limited. Industrial standards such as NIST 800-53, 160, 161 & 171[6,7,8,9] are much more detailed, and potentially have applicability to commercial markets, though standard selection and optimization is needed to achieve an optimal domestic production ecosystem which is compliant with standards for synergistic Government and commercial market applicability. The aforementioned 2020 NDAA Section 224 directly reads on this need.

Present US Export Control Regulations are not optimized, limiting industry participation in delivering technologies for products subject to highly controlled export categories. The protection of controlled information is critically important to both Government and Industry Microelectronics programs. For Government, inadvertent or unauthorized disclosure of controlled information can result in handing adversaries the keys to the kingdom, enabling reduced time to compromise for critical Government systems. For industry, controlled information is the lifeblood of fabless semiconductor companies, the value of which enables such US Companies to lead the world in total Microelectronics sales. Clearly there is a common goal between Government and industry, to protect controlled information from unauthorized disclosure. The means of protection implementation however differs, with Government focused on performance in the U.S. with access restricted to U.S. nationals, and industry heavily leveraging need to know access controls in compliance with non-disclosure agreement terms. Industry is often reticent to implement compliance programs for highly controlled export categories due to increased cost, reduced flexibility, and the potential for heavy fines if export violations occur. Immediate opportunities present for Government to mutually develop with industry a definitive list of data types and articles subject to nationality restrictions to minimize scope of control programs within industry. Government led whole of Government demand and incentives for industry to close business cases for compliance are also recommended.

 

# Recommendations

Recommendations are based on input from NDIA Electronics Division members and organized to align with the findings in the previous section. These include suggestions to align Industry and Government business practices, improving Public-Private Partnerships, and optimizing DoD Procurement Standards.

## 1. Need for Speed: Establish a New Paradigm and Better Alignment for Commercial Industry and DoD Business Practices

1.1 **Balance Defense needs with incentives for commercially viable business outcomes required by Industry.** This can be accomplished through sustained large-scale R&D investment, coupled with funding and public private partnerships for onshore manufacturing with focus on existing and brownfield facilities and rapid adoption of new technologies for use in market sectors including 5G, Internet of Things, Artificial Intelligence, drones, and autonomous vehicles.

Since Government programs rely upon next generation technologies from industry, close cooperation between the USG and industry will be needed to ensure a robust on-shore technology sector and to further bolster the domestic Microelectronics industry's position as a significant economic engine of the U.S.. *These products, manufactured in the U.S. with new invigorated technology and American invented and owned IP, can be leapfrogged forward.*

1.2 **As recommended in the Future of Defense Task Force report[10], DoD should identify, replace and retire costly and ineffective legacy platforms**. NDIA Electronics Division members stand ready to assist in this effort. While it will be a significant effort for both DOD program managers and the Defense Industrial Base members supporting them, ultimately this will increase national security and competitiveness.

1.3 **DoD should take concrete steps to adopt industry standard practices.** Long-term cooperation and investments more in step with industry planning cycles is required. This will enable on-shore Microelectronics capabilities to support and sustain current and next generation systems, and help drive synergistic industry demand.

1.4 **Catalog current programs and improve forecasting of Government Microelectronics needs.** Understanding and aggregating whole of Government demand and providing clear non-binding forecasts can help Government optimize its' technology selections and buying power, and help commercial industry to develop investment plans that address consumer volumes in complement with Government program niche needs. Forecasts should be published at least semi-annually.

1.5 **Strategically address obsolescence across the portfolio.** Understanding whole of Government demand will enable effective trade off decisions to select from (1) demand signals for industry to sustain production where sufficient whole of Government demand exists, (2) lifetime buys, (3) incentivized re-shoring of designs to technologies with desired longevity, or (4) re-design to new components with secured sustainment. Core to this sustainment activity is an on-shore supply base which is financially viable for the duration of need. Pro-actively addressing obsolescence will increase national security and competitiveness.

 

1.6 **Continued compensation to industry for inherent 'low-volume' & 'high-mix' Government electronics demand must be achieved to incentivize suppliers to serve these markets.** This will encourage suppliers to balance the capacity for Government demand against much higher volume commercial business prospects, which are necessary to support the immense capitalization required for this industry.

1.7 **Implement new policies to encourage on-shore growth and stability.** This includes requiring that Government contract awards are restricted to trusted and assured on-shore supply chains, inclusive of sub-tiers, when available. Section 224 of the 2020 National Defense Authorization Act[11,12] calls for this strategy to drive Government demand in a manner that includes consideration of location (put Government buying power at work for on-shore) and to drive non-traditional on-shore commercial demand from markets such as 5G, AI, autonomous vehicle, and other related critical infrastructure, to mutually address supply assurance and demand for long-term viability of the on-shore supply base.

1.8 **Adopt Intellectual Property policies that create incentives for industry with dual use of the IP for commercial market sale, while protecting narrow differentiating aspects that must remain export controlled for the Government.** Intellectual Property (IP) ownership and use rights are the lifeblood of fabless semiconductor companies, and the reason why U.S. companies lead the world in Microelectronics product revenue. Care must be taken to mutually satisfy Government security requirements while also simultaneously addressing commercial business needs.

1.9 **Fully fund CHIPS/AFA and target these investments in a commercially viable manner.** This will help achieve desired on-shore technology mixes, with capable industry partners willing to enter commitments commensurate with investment incentives for long-term supply. This will flip the current paradigm, which leaves the Government with no control over technology longevity, and appropriately established long-term partnerships with industry.

## 2. Create Public-Private Partnerships That Meet the Needs of the Full Microelectronics Ecosystem

2.1 **Public-private partnerships should fully leverage existing on-shore assets to maximize return on investment and minimize time to capability.** This includes existing brick and mortar and new brownfield efforts. Existing facilities can be expanded for new capability or additional capacity to meet both Government and commercial needs, especially if aligned with planned commercial updates. New brownfield semiconductor fabrication facilities can leverage local infrastructure and workforce to optimize investment outcome.

2.2 **Create incentives for states to co-invest in PPP facilities. One way to accomplish this would be to provide applicants for grants under CHIPS/AFA programs with higher scores depending on the level of State, as well as private sector, cost share.**

2.4 **Establish national infrastructure program to drive complete stand-up of 5G/6G manufacturing capabilities on US soil to support the entire supply chain from design to network deployment and maintenance.** In addition to deployment of the network, the following activities described in the January 2017 REPORT TO THE PRESIDENT[13] Ensuring Long-Term U.S. Leadership in Semiconductors should be enabled: (1) Development of a high-speed biological, chemical, and/or nuclear threat detection network through deployment of electronic devices that incorporate chemical, bio-chemical, spectral imaging, and radiation sensors in addition to sensors for primary functions, that would cut detection times by an order of magnitude, (2) Sensor and communications support for a decentralized power system to enable better usage of the complete portfolio of power technologies, including renewables, and (3) Deployment of a global weather forecasting system with a fidelity of 1 km using innovative, high-efficiency, domain-focused architecture. Smart phones and IoT devices, in combination with this 5G/6G network and the Internet, would form a vast sensing and communication network to enable the aforementioned goals and numerous others.

2.5 **Make workforce development a key component of each PPP.** A vibrant and available domestic production ecosystem, with a sufficiently broad and capable workforce, is needed. Flexibility is essential. This will follow from increased investment and correctly aligned long-term planning.

2.6 **Ensure adequate funding throughout the life of the PPP.** Current models used by the Government (such as the National Manufacturing Institutes) require each PPP to become financially independent. Given the public mission of these organizations and prohibitive overhead costs, a better approach would be to have the Government continue to invest over the life of the PPP and to re-evaluate every few years whether the PPP is fulfilling its' mission.

## 3. Need for Clarity: Develop and Implement Comprehensive Government (including DoD) Microelectronic Procurement Standards and Metrics

3.1 **Define targeted requirements and drive adjacent commercial market demands.** This includes addressing gaps in DoDI 5200.44, which is too generic/high-level and targets DoD only uses. Recent legislation under the FY20 NDAA, Sec. 224, identifies specific goals and actions required of the DoD to address both DoD procurements, and those of critical industry sectors, such as 5G.

3.2 **All viable supplier options, including non-traditional, must be available**. Flexibility in contracting frameworks is required. Such flexibility promotes more efficient engagements and will attract non-traditional performers.

3.3 **Commercial Industry should be encouraged to see small volume programs as an opportunity to explore potentially differentiating technology.** Small demand signals from the Government need to be reframed as being a bonus. Needs can be organized into a context of technology, which could benefit adjacent commercial applications and use cases. In the case of Strategic Radiation Hardened electronics, the reapplication of defense-oriented techniques could be reframed as reliability improvements with a broader impact in automotive, commercial space, etc. If this covers 90% of the need, the remaining 10% falls to the Government to own.

3.4 **Coordinate and consolidate USG programs.** Better coordination across Government is needed and individual programs should be consolidated where possible. This will address workforce related issues by achieving more goals across fewer programs with the same number of resources.

3.5 **Leverage modular platform architectures.** This will simplify and enable ability to refresh technology while supporting redundant suppliers, thus improving supply chain agility. Within this strategy, the Government will need an ecosystem of performers to be successful, and commercial industry will need to be comfortable that their strategy, IP, and financial wellness are all adequately taken into account and protected from broad sharing.

3.6 **Adapt Export Control and data restriction techniques to current realities and provide flexibility.** A Hybrid approach is needed to address the needs of both Commercial industry and Government, and in a coordinated fashion. The outcome of this new approach must be better than either of the individual Government and industry approaches separately in order to encourage adoption.

 

# Conclusions

Through this document, suggestions from NDIA Electronics Division Stakeholders representing commercial Industry were presented to provide a clear set of actions, which when put into practice, will lead to better outcomes and cooperation.

Specifically, we suggest:

- Tight coordination of policy and actions across commercial Industry and Government
- Rapid update of policies to match current global realities
- Seek out and exploit technology adjacency where possible and cover the cost of additional deviation
- Increased flexibility in acquisition, execution, protection, and commercialization of Government and commercial Industry critical technologies
- New and improved industry standards, which accurately and thoroughly describe requirements to achieve demand for an optimal domestic production ecosystem

If these recommendations are implemented, holistically and comprehensively, through open dialogue and coordination between, and across, Government with commercial industry, the Nation can accelerate sustained long-term leadership and technological dominance. This will directly improve nationally-critical infrastructure, national security, and technological posture while accelerating, reinforcing, and growing the domestic capabilities necessary for leadership and sustained Microelectronics domination.

 

# References


1. S. 4130: American Foundries Act of 2020
   Introduced July 1, 2020 - 116th Congress (2019–2021) - A bill to require the Secretary of Commerce to award grants to States for the construction of Microelectronics manufacturing and advanced research and development facilities, to authorize the Secretary of Defense and the Director of National Intelligence to fund the construction of Microelectronics manufacturing facilities for national security needs, and to authorize additional amounts for Microelectronics research and development, and for other purposes.
2. S. 3933: CHIPS (Creating Helpful Incentives to Produce Semiconductors) for America Act
   Introduced June 10, 2020 - 116th Congress (2019–2021) - This bill establishes investments and incentives to support U.S. semiconductor manufacturing, research and development, and supply chain security.
3. S. 4049: National Defense Authorization Act for Fiscal Year 2021
   Introduced June 23, 2020 - 116th Congress (2019–2021) - An original bill to authorize appropriations for fiscal year 2021 for military activities of the Department of Defense, for military construction, and for defense activities of the Department of Energy, to prescribe military personnel strengths for such fiscal year, and for other purposes.
4. The Semiconductor Research Association (SIA) Decadal Plan provides an overview of the global drivers and constraints for the future ICT industry, focusing on creative solutions and measured impact. The Decadal Plan has three key objectives: (1) Identify significant trends, applications, and challenges in semiconductors that are driving information and communications technologies (ICT), (2) Quantitatively assess the potential impact of the five seismic shifts on ICT (3), Identify fundamental goals to alter the current trajectory of semiconductor technology to better address coming challenges.
5. DoDi 5200.44 establishes policy and assigns responsibilities to minimize the risk that DoD's warfighting mission capability will be impaired due to vulnerabilities in system design or sabotage or subversion of a system's mission critical functions or critical components by foreign intelligence, terrorists, or other hostile elements.
6. NIST Special Publication 800-53 provides a catalog of security and privacy controls for all U.S. federal information systems except those related to national security. It is published by the National Institute of Standards and Technology, which is a non-regulatory agency of the United States Department of Commerce.
7. NIST Special Publication 800-160 addresses the engineering-driven actions necessary to develop more defensible and survivable systems including the components that compose and the services that depend on those systems.
8. NIST Special Publication 800-161 includes guidance and recommendations for supply chain risk management practices for Federal information systems and organizations.
9. NIST Special Publication 800-171 addresses protection of Controlled Unclassified Information (CUI) in Nonfederal information systems and organizations.
10. The Future of Defense Task Force Report, released in September 2020, makes identifies a wide variety of challenges facing the DoD in order to ensure sustained technological dominance. One of the recommendations made by the Task Force is “Congress and the Department of Defense must identify, replace, and retire costly and ineffective legacy platforms. The Task Force


 

recommends that Congress commission the RAND Corporation (or similar entity) and the Government Accountability Office to study legacy platforms within the Department of Defense and determine their relevance and resiliency to emerging threats over the next 50 years."

11. S. 1790: National Defense Authorization Act for Fiscal Year 2020
    Introduced June 11, 2019 - 116th Congress (2019–2021) - An original bill to authorize appropriations for fiscal year 2020 for military activities of the Department of Defense, for military construction, and for defense activities of the Department of Energy, to prescribe military personnel strengths for such fiscal year, and for other purposes.
12. S. 224: National Defense Authorization Act for Fiscal Year 2020
    Introduced June 11, 2019 – 116th Congress (2019-2020) – A bill that requires defense Microelectronics products and services meet trusted supply chain and operational security standards.
13. The Economic Report of the President is an annual report written by the Chair of the Council of Economic Advisers. An important vehicle for presenting the Administration's domestic and international economic policies, it provides an overview of the nation's economic progress with text and extensive data appendices.
    https://obamawhitehouse.archives.gov/sites/default/files/docs/2017_economic_report_of_president.pdf

 