KEY U. S. R&D INFRASTRUCTURE TO MAINTAIN AVIATION AND DEFENSE INDUSTRY STRENGTH

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The United States economy and national security is dependent by our country's ability to innovate and drive new technologies. In a broad sense the emergence of new technology increases productivity, facilitates commercial trade, strengthens the U.S. defense lead over our adversaries. A fundamental approach to retaining our country technological prominence requires continuous public and private investments for the research capability and infrastructure, specialty and skilled workforce, and collaboration between industry, government, and academia.

The development of new technologies requires not only enhancing, updating and protecting current research and test infrastructure, it requires supporting labs that develop and qualify the emerging technologies, and training the workforce to run the research and development system. The Aerospace Industries Association has identified several infrastructure capabilities that should be supported by the U.S. government through legislative appropriation and agency budget process.

Critical U.S. Capabilities to Secure U.S. Advanced Microelectronics for aerospace and defense applications:

To ensure U.S. leadership in the global semiconductor industry continues and to reverse the trend for diminishing US-based semiconductor manufacturing, there is a need for increasing federal investments in semiconductor research and domestic manufacturing incentives. This will contribute to maintaining or establishing critical U.S. capabilities for secure U.S. advanced microelectronics including DoD/IC specific microelectronics (analog, RF, radiation hard, etc.), state-of-practice trusted foundries, state-of-the-art domestic foundries, printed circuit board supply base, and research and prototype capabilities. These investments will substantially increase:

1. U.S. investments in semiconductor-specific research labs across federal scientific agencies, academia and industry to advance new materials, devices, designs, and architectures that will lead to exponentially increasing chip performance.
2. U.S. research investments in labs in semiconductor-related fields such as material science, computer science, electrical engineering, and applied mathematics across federal scientific agencies, academia and industry to spur leap-ahead innovations. Establish manufacturing grant programs to encourage construction of new onshore advanced semiconductor and advanced packaging manufacturing facilities in the U.S., including leading-edge logic foundries, advanced memory, and analog fabs to supply defense (including defense specific requirements), critical infrastructure, and other essential commercial needs. Provide tax incentives for the purchase of new semiconductor manufacturing equipment tied to these same needs. Support the domestic microelectronics investment recommendations in R&D and manufacturing.

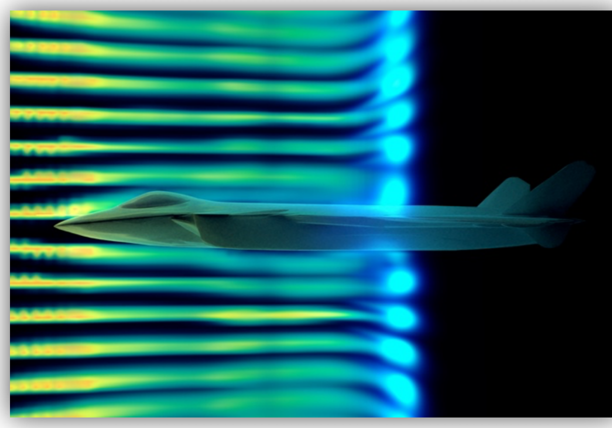
Hypersonic Vehicles, Test Facilities, Expert Scientists and Technicians:

Development of hypersonic vehicles, test facilities, expert scientists and technicians require investments to ensure our country outpaces adversary's development of this technology. To adequately support this capability there should be additional R and D funding for development of ground and range-based testing of hypersonic vehicles and propulsion systems with sufficient security. This area requires additional labs and qualification sites for specialty materials, structures, electronics/sensors which enable hypersonic products. And finally ensure there are adequate manufacturing and test capabilities and ranges to build and test full prototypes.

Materials & Processes Qualification:

Fundamental technology enabling design of new materials for aerospace applications. Additional investments are needed for test labs to production scale up facilities with Integrated computational materials engineering infrastructure and skilled scientists to develop, evaluate, qualify, and create new materials and manufacturing methods and their associated standards. This area includes investment requirements for advanced and additive manufacturing.

Artificial Intelligence (AI) and Machine Learning (ML) Infrastructure



To foster further development of AI and ML there is a need to increase the talent pipeline (i.e. data scientists), equipment and infrastructure for research at universities, national labs and secure defense test facilities. Corresponding to these requirements critical components for advancing state-of-the-art AI and ML are data storage, access, and highly parallelized computing. Also, current computing infrastructures will need to be updated such that it will have compatible architectures consistent with modern software DevSecOps practices that enable industry to leverage and collaborate using these resources.

National labs and test facilities addressing critical Aviation and Defense missions

National labs and test facilities are key to more efficient propulsion, materials, production methods and sensors. The U.S. must: (1) expand the pool of skilled staff to operate characterization test equipment capable of multiphysics-based testing; (2) Acquire processing equipment to manufacture test component and load frame and test equipment to structurally test designs; (3) Provide test and validation capability for Radio- Frequency (RF) components in standard to high temperature environments. There must be sufficient ground and range-based testing infrastructures and test capabilities for exposure to lightning strikes, other electromagnetic effects, and environmental conditioning; test labs and ranges for directed energy technologies and defense from EMI/EMP weapons. Finally need to expand test capabilities to address U.S. climate defense and mitigation needs.

High Performance Computing and Cybersecurity, including transmission of data through supply chain:

A national infrastructure is required to support intensive computing that is needed to improve the accuracy, efficiency, and robustness in the design and production of A&D systems and platforms. Training infrastructure to produce workers with formal cyber capabilities to build and maintain cyber hardened devices, embedded software, Field Programable gate arrays, and networking. Addressing secure data transmission from customer through supply chain and sustainment is critical to the defense of the nation.

System cyber-resiliency throughout the defense Digital ecosystem is critical to the protecting the nation's defense industrial base. Protecting critical networks is addressed by Cybersecurity Maturity Model Certifications (CMMC) and NIST SP 800-171 controls. The foundational support for Digital resilience includes development of the cyber talent pipeline and expanding research capabilities at universities such as the National Strategic Computing Initiative (NSCI). Also enabling and ecosystem that allows Data exchanges quickly and securely leveraged between government customers, OEMs and suppliers with:

1. Secure data transmission, storage and interoperability
2. High Performance Computing (HPC) to support workloads,
3. consistent and effective architectures and standards to train, deploy, and manage analytics.

Manufacturing Capabilities and Resiliency

Overseas institutes are providing critical training to scientists and their supply base workforce. They are also reducing the cost and risk of technology maturation. Investments have been made in support of institutes and labs that develop advanced manufacturing initiatives with public and private partnerships including Manufacturing USA, the National Network for Manufacturing Innovation institutes and similar labs. Currently, there are 16 manufacturing innovation institutes under Manufacturing USA that are sponsored by either the U.S. Department of Commerce, Defense, or Energy. Many of these labs were created with the understanding that that would become self-funded businesses ventures over the course of 5-years. However, the time needed to develop their technologies, the consistency and efficiency in their processes exceeded this window for these enterprises to compete. Also,these institutes should team with training centers to strengthen the capabilities of the broader U.S. Manufacturing workforce. They, along with NIST, are also key in the validation and verification of new standards.

Conclusion:

These technology capability investment areas are not an exhaustive list that the U.S. should fund, rather it is a set of recommendations that were developed with the Aerospace and Defense technical community's knowledge of constrained sources, current development capabilities that require enhancements, reliance on offshore sources, address supply chain risk and resilience, increase awareness and offset adversary competence and development of new and emerging technologies. Dialogue is necessary to exchange information and discuss priorities with U.S. government and refine the priorities and interests of the nation.