Prepared Statement by

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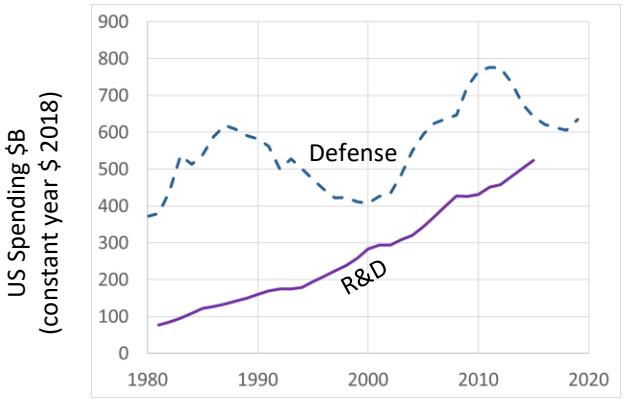
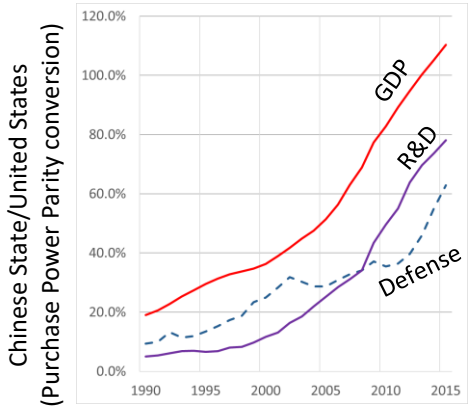
Chairman Langevin, Ranking Member Stefanik, and distinguished members of the committee, I thank you for the opportunity to appear today. I am honored to personally testify today before the Cyber, Innovative Technologies, and Information Systems Subcommittee to the House Armed Services Committee. This is my first individual appearance as an expert having departed the Pentagon in 2019. After my tenure leading the electronic warfare portfolio in the Pentagon, you may wonder why I transitioned to the private sector and now partner with multiple non-profit organizations. The answer is quite simple, the innovation needed to support our electromagnetic spectrum operations capabilities occurs substantially in the private sector. I believe that our Nation must make it a priority to identify ways to make these commercial advances profoundly more accessible to the DoD.

A year ago, I performed an analysis between the Chinese State and the United States; particularly, comparing the size of the economy, of defense spending, and of R&D spending. I performed this comparison using Purchase Power Parity exchange ratios (not a simple exchange ratio). What I found is that the economy of the Chinese State is already 10% larger than that of the United States. Fortunately, the Chinese State invests only 80% as much into R&D and 60% as much into Defense as we do in the United States. Unfortunately, as the size of the Chinese State economy continues to grow, we should expect their R&D and defense budgets to continue to grow as well. This is a very different strategic situation than we faced during the Cold War – the Soviet Union's economy never approached parity with the United States.





I believe the strategic question we are faced with today is this, "how do we want to compete?" Since World War II, the US has largely leveraged manufacturing capacity as a proxy for military strength. However, globally we have transitioned into the Information Age, a landscape in which global leadership is defined by innovation, technology development, and technology adoption and integration. Formed in 2015, China's Strategic Support Force bundles electronic warfare, cyberspace operations, and space operations for a strategic advantage; all three functions are truly equals based on my research. China's Strategic Support Force reports directly to their Central Military Commission; based on their

organizational chart, they are a peer to the PLA Army, Navy, Air Force, and Rocket Force Headquarters. In comparison, the United States has maintained electromagnetic warfare and spectrum management as capabilities to achieve tactical outcomes. Our organizational charts reflect this tactical prioritization. Our competitive strategy must reflect that we are in the Information Age, and our strategy must also reflect our competitors' strategies.

At the operational and strategic level, successful warfighting depends upon the collection, aggregation, and analysis of information. This information allows commanders at all tiers to make timely, and well-informed decisions. As poor decisions made quickly have disastrous consequences, simply improving the speed of decision making is inadequate. Evolutionary improvements in weapon systems are expected to continue, the disruptive opportunity is manipulating the collection, aggregation, and/or analysis of information. While we disrupt an adversary, we must simultaneously protect and ensure that accurate data and information forms the basis for decision making by our commanders.

Military operations largely depend upon sensors that operate in the electromagnetic spectrum. Of military interest, the electromagnetic spectrum includes the optical, infrared, and radio spectrum. These portions of the spectrum allow electro-optics, infrared search and track, and radar sensors to detect, track, and target a threat. Electronic warfare, now called electromagnetic warfare, allows the innovative manipulation of this data.

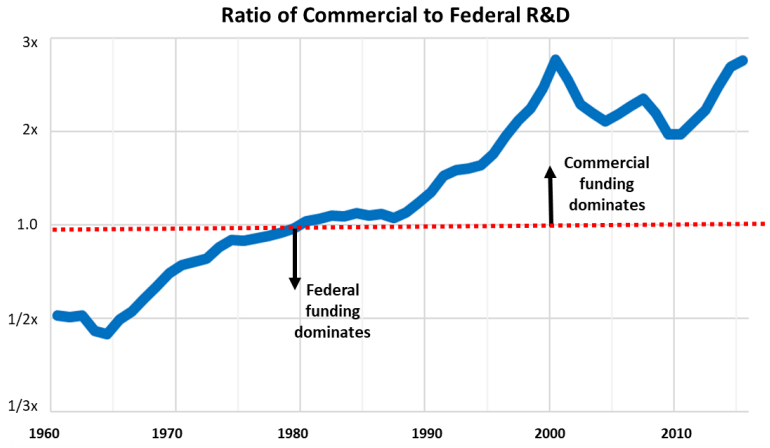
Electromagnetic attacks can deliberately interfere with the aggregation of data by an adversary. While commonly called jamming, this has occurred in all military operations since World War I. While the best artificial intelligence can analyze reams of data automatically, AI struggles to discriminate against bad & corrupted data. The adage "garbage in, garbage out" still applies today. Electromagnetic battle management, the dynamic reconfiguration of our sensors, our networks, and our electromagnetic attacks in realtime may be a preferred offensive strategy when compared to the defensive utilization of the electromagnetic spectrum in an integrated air and missile defense system, often called an IADS. Strategically, we may discover that EMSO offers a sustainable strategic advantage in our favor.

As a Nation, the United States should choose to pursue a strategy based on innovation: in our technology development, in our adoption of these innovations for our national defense, and in the full integration of these innovations into military tactics and operations. This is a dramatic departure from the platform and program-centric investment strategy we have pursued. Instead of viewing capability gaps and shortfalls, EMSO can generate opportunities and leverages the best of our private sector in support of our national defense. To remain a global power, the United States and our allied partners must pursue a strategy to leap ahead, not to merely close a gap.

Microelectronics underpin all the capabilities discussed today. Global market data published by the World Semiconductor Trade Statistics Organization estimates that less than 1% of microelectronics are used in military applications. As smart devices continue to improve lives, the defense market share will continue to shrink – this is true for both developers as well as fabrication of semiconductors. A deliberate strategy is required to ensure both innovation and access. The largest microelectronics designers and suppliers have market caps which are 2-5x greater than companies which deliver many weapon systems to the DoD each year. Addressing our national microelectronics challenges is a necessary, but not sufficient, step to addressing our EMSO challenges. Both of these priorities must be pursued simultaneously.

Largely due to privity of contract concerns, our nation has chosen not to fully utilize the innovative muscle that exists across the United States' Innovation Base. I am deliberately treating this Innovation Base as being separate from our Industrial Base. While the latter is focused on producing products, the former is focused on producing value. There is an extensive historical justification for the focus of the industrial base to maximize the return on invested capital for investors. While a full description is beyond the scope of discussion today, this legacy dates to the industrial might of the US in the first half of the 20th century. Over the past 50 years, we have seen a continued globalization as well a fundamental shift in where value is created in our innovation base. Incentives that reward growth and innovation can drive needed capital investment into EMSO capabilities. Growth-centric young innovators want to work at companies where all employees have equity; current acquisition regulations do not treat this as a reimbursable cost.

The National Science Foundation's annual Science & Engineering Indicators report shows that the United States Government today accounts for approximately a quarter of our economic investment in R&D. The government should seek to maximize the value of this investment. I expect this trend will continue into the future and must be leveraged in our strategic thinking.



Several recommendations could improve our EMSO ecosystem:

- Incentivizing R&D investment by commercial companies; and particularly ensure that the US tax code does not penalize R&D investment for future innovations. I endorse H.R. 1304, The American Innovation and R&D Competitiveness Act.
- Develop a strategic framework for innovation by traditional defense contractors as well as non-traditional commercial companies. One size does not fit all for these different business models. Innovative, rapidly growing commercial companies are likely to invest more in internal R&D; this is desirable for EMSO and government policies should not attempt to limit investment and growth. The DoD should study this concept, establish needed strategy and policy to grow innovative solutions, as well as innovative companies, for our national security challenges.
- Develop policies to share data broadly and democratically across our national innovation base. Government furnished information should be available to the entirety of the supply chain. Currently, privity of contract limits interaction and the sharing of taxpayer funded insights. Any insights, reports, and deliverables generated on government contracts, or by government

thought leaders, should be broadly available to those with a need-to-know. Non-profit associations and institutes could offer effective distribution of these insights.

- Ensure a realistic EMSO environment and threat capability. This is critical in all Live, Virtual, Constructive environments. Additionally, a realistic environment and threat capability must analytically support budget development. Certifications by USD(P&R), the Joint Staff J7, and the Director of Cost Assessment and Program Evaluation (D,CAPE) could be used to enforce compliance.
- Establish strategic offensive EMSO function, similar to what China has done with their Strategic Support Force. I advise assigning a single Service responsibility for this function and then prioritizing funding to man, train, and equip these forces.

While organization and authority are important, the greatest risk I see is continuing to apply legacy strategies to the realities of today. I again thank you for the opportunity to testify and look forward to your questions.