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Statement before the Senate Committee on

Commerce, Science, and Transportation

"Implementing Supply Chain Resiliency"

A Testimony by:

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Chair Cantwell, Ranking Member Wicker, and distinguished Members of the Committee, thank you for the opportunity to testify.

The United States is creating the policies and tools needed to defend ourselves against a hostile, authoritarian China. To do this, the U.S. will need new technological and industrial strategies that will allow it to maintain its national security and economic strength. We are in some ways at the start of the undertaking. Congress and the new Administration, with the *United States Innovation and Competition Act (USICA)*, and the Administration's Executive Order 14017 and 100 Day Review, have taken important steps in this direction. Much of the burden now falls on agencies like the National Science Foundation (NSF), the National Aeronautics and Space Administration (NASA), and the Departments of Commerce and Energy.

For more than two decades, the U.S. depended on a global supply chain that provided lower cost and greater efficiency. Two things broke that global supply chain. The first is the rise of a predatory China that will use any means to displace competitors in its quest for global primacy. The second is the COVID-19 pandemic, which produced an understandable desire in many nations to reduce their dependence on foreign suppliers and instead rely on national capabilities. Many countries became uncomfortable when they realized that critical medical supplies were only available from sources like China. They want to move some critical production back onto their territories. Now the U.S. and the EU are taking a harder look at reshoring. In a way, this mimics China. Chinese policy has always pursued indigenous capabilities to reduce reliance on foreign suppliers. This supply chain nationalism is reinforced by growing and powerful competition for technological leadership and by events like the semiconductor shortage.

There is a degree of wishful thinking in some Western countries about this contest, that hope that there can be normal commercial relations with China despite stark political differences and predatory behavior. Even if one is willing to put aside any qualms about doing business with regimes that routinely violate the rights of their citizens, the governments of China and Russia have decided that the U.S. goal of building a world made up of market democracies is a threat to their survival. They have further decided that the U.S. is in irreversible decline and now is their moment to push for a world that they can dominate. The end of the Cold War in 1989 and the few decades of American primacy, now ended, are best seen as an interregnum in a longer conflict between democracy and authoritarianism. We are in many ways behind in this contest, but this can be remedied.

This is where the USICA plays a vital role. Past industrial strategies built munitions or heavy industry, but are now outdated. We need a new style of industrial policy that takes into account globalization, the leading role of the market and private sector in innovation, and the need to ensure resilience in emerging technologies.

A high-tech industrial strategy fundamentally has two complementary parts. The first is restrictions on technology transfers to opponents. Congress has strengthened protective measures for competition with China with the *Foreign Investment Risk Review Modernization Act* and the *Export Control Reform Act*. These are important components of a tech strategy.

The second part is to build and accelerate technological resilience. The high-tech industries we have today are built on a foundation of federal funding, but in the intervening thirty years, there have been significant changes in our economy and innovation system. An industrial strategy today needs to take into account these changes and be guided by three dominant factors: the global supply chain for innovation and technology, the importance of federal funding, and the central role of markets and the private sector in tech competition.

Previous Efforts at Strategic Industrial Policy

Historical precedent can be an ambiguous guide for policymaking. Many people talk of a new Cold War between China and the U.S. But the globalization of supply, China's dynamic, quasi-market economy, and the reluctance of some key allies to abandon the Chinese market make for a very different world than the bipolar landscape of the Cold War. The 1930s and the rise of authoritarian states bent on confronting democracies is a better precedent than the Cold War, but it too falls short. This new contest with China will last longer and the emphasis is on tech leadership and controlling a global narrative of economic success more than on displaying military power. These past experiences do not provide a perfect roadmap for action, but we can still draw important lessons from them.

In the 1950s, the Eisenhower Administration expanded the technology base created for the World War II with massive federal funding and the establishment of an institutional framework with entities like NASA and the National Science Foundation. In the late 1970s, the Department of Defense (DoD) focused research on technologies that would offset the Soviet numerical advantage in munitions weaponry. These investments in precision munitions, stealth, sensors, and communications created a "Revolution in Military Affairs." The Eisenhower Administration's support for R&D to expand STEM education and workforce were foundational for America's tech success in the last sixty years and provides a useful precedent we should copy. Technology gave America unquestioned military superiority for decades, but this unquestioned superiority has ended as other advanced states challenge American technological leadership. USICA begins the work to restore it.

America has cut defense spending after every war. In the 1990s, we assumed conflict with peer competitors was a thing of the past. This ultimately proved to be wrong, but made it seem safe to make significant cuts in federal R&D spending after the Cold War. Congress increased spending on life sciences, but trimmed "hard" sciences like physics, math, and materials. Government funding is essential for basic research in these areas—research that by itself has no immediate commercial value but creates the basis for commercially valuable innovation. Americans did not stop innovating after these cuts—if anything, innovation increased with the introduction of digital technologies—but it was private sector innovation aimed at commercial markets.

USICA, when it is funded, will begin to remedy these mistakes. It is a good start for repeating earlier successes in using technology to advance national security and build economic strength. But today's policy needs to acknowledge that there are crucial differences in how America creates new technologies nowadays. America's national innovation base has changed dramatically. Twentieth century American innovation was national, but today's innovation base is international, with strong research and commercial links between the United States, Europe,

and Asia. Efforts at "reshoring" will not change this. While these connections can create security risk when it comes to technology transfer to hostile states, they also provide benefits that outweigh risk. A country that cuts itself off from this international innovation system will fall behind. These changes make it necessary to find ways to take advantage of a multinational commercial innovation base that leads R&D for new technologies, including 5G, artificial intelligence, biotechnology, quantum computing and alternative power sources.

The Role for the U.S. Department of Commerce

The deep interconnectedness between the U.S. and the Chinese economy forged over forty years created both opportunity and risk. We do not need to abandon a global supply chain but to shrink China's role in it. Complete bifurcation is unnecessary as there are some technologies that can be safely transferred to China while others must be restricted. The Commerce Department could make this distinction as part of its export control process. It is in the national interests to allow our companies to take advantage of the Chinese market in ways that minimize risk for as long as possible. The United States has made good progress in restricting China's ability to acquire American technology—a key part of China's modernization plans—with Congress's passage of the *Foreign Investment Risk Review Modernization Act* of 2018 and the *Export Control Reform Act* (although it has had implementation problems).

These two Acts, however, are defensive. Denying China access to technology is not enough. We know from the American experience in the conflicts of the twentieth century that the U.S. must also strengthen its own technological base in this new and long-term competition with a hostile and authoritarian China. This is where the USICA is vital to protecting American security. However, the industrial policy models of the twentieth century are no longer effective. Nor do we wish to copy China's state-directed economy. Finding a new model of federal intervention to bolster our technological base in the competition with China will be difficult.

Implementation points to the critical role of the Department of Commerce. If there is a precedent here it is the difficulties in implementing the *Export Control Reform Act*. For years, Commerce defined itself as an export promotion agency and this still has a powerful influence over its culture. The export controls Commerce is charged with administering are still largely based on the Cold War technology framework enshrined in the Wassenaar Arrangement. Sometimes agencies can modernize themselves, other times it takes Congressional direction and leadership. Thinking about what a twenty-first century Commerce Department should look like may be a good task for the committees of jurisdiction in their oversight function.

These difficulties may be less of an obstacle than they may appear, because in fact, the decisions and strategies needed to implement USICA will be made in the White House, at the NEC and NSC, and by Congress. Commerce will implement these policies and how it does so will be crucial in determining their success. In this, we can suggest two principles to guide Commerce: first to focus on emerging and foundational technologies, and second to build a symbiotic relationship with America's fast moving, risk-taking, entrepreneurial business culture.

Commerce should focus its efforts on key technologies and design policies that as much as possible reinforce the private sector. The comparatively smaller size of federal investment versus

private sector investment alone makes this a good choice. We are in a competition between economic models, between China's increasingly state-centric economy and our market driven model. A key task for policy is to identify where federal intervention is necessary, and USICA's identification of ten key technologies categories is where the U.S. should focus its activities.

USICA gives Commerce the authority to establish a supply chain resiliency program, to encourage cooperation between the Department and the private sector to identify supply chain problems and develop solutions. Supply chain issues that arose from the global COVID-19 pandemic are one reason for these provisions. Hence, the supply chain program should initially prioritize semiconductor supply chain issues, and only cover other supply chain issues in the future.

The most immediate of these areas involves semiconductors. Federal support is necessary to achieve two goals: to move more production capability back to the United States and, to a lesser extent, to increase productivity capability (less because private sector investment will do this). We do not want to duplicate China's error of investing billions in inefficient or outmoded semiconductor production. We do want to invest in location subsidies, in research, and in opposing anti-competitive behavior.

Semiconductors

Semiconductors are the foundational technology of the twenty-first century. The United States needs to remain strong in this industry, but in the face of global competitors that make heavy use of subsidies, it will need government action and funding to maintain its position. The United States still has the largest share of the global semiconductor market. It leads in chip design and it has roughly half of the global market for semiconductor manufacturing equipment, but it lags in chip fabrication. This lag is the source of supply chain risk.

A 2019 OECD study found that of the dozen or so countries with significant semiconductor industries, only the United States did not use subsidies. We may not like it, it may not be fair, but subsidies are part of the market and the failure to provide location incentives is one primary reason why the U.S. share of semiconductor fabricating facilities has fallen by two thirds and chip fabrication moved offshore.

The semiconductor industry has a globally distributed supply chain. This is the most economically efficient, but it now creates security risks. Our goal should not be to abandon the global supply chain but to reduce China's role in it. This will not be easy, but complete bifurcation is unnecessary. We want to avoid ending up in a position where China is the sole supplier for any segment of the chip supply chain, because they will take advantage of this to harm us. That does not mean that companies and facilities outside of China that provide key parts of the chip supply chain —in Israel, Ireland, and others— should be replaced. We benefit economically and strategically from maintaining a global supply chain in which China's role has been decreased. China exploits us. We should in turn exploit the Chinese market as long as possible and as long as our technology transfer controls are working. This means selective decoupling and allowing some economic interactions to continue.

One open question is Taiwan. The Chinese government's ultimate intent is to absorb Taiwan as it absorbed Hong Kong, but Taiwan will be more difficult to absorb and China may never succeed. But the intention creates risk. We depend on Taiwan for advanced fabrication of chips. This dependency requires that we ensure Taiwan's autonomy from China, but also that we ensure resilience by getting key Asian firms to locate some of their facilities in the United States. This can be part of a larger effort to build resiliency and security by strengthening all segments of the U.S. chip industry, through investments in R&D, workforce, and subsidies, including support for other parts of the semiconductor supply chain, such as advanced packaging.

The Administration's 100 Day Supply Chain Review offered seven recommendations to strengthen the U.S. chip industry. These include a call to fully fund the *Creating Helpful Incentives to Produce Semiconductors* (*CHIPS) for America Act* (which has been languishing in Congress for a year), measures to strengthen the entire chip supply chain, build the STEM workforce, use export controls to protect technology, and work with allies to harmonize policies on R&D and China—key allies like Japan are ready to do this. The recommendations in the 100 Day Review, particularly if combined with Congressional guidance and action on funding, will keep the United States strong in this core technology.

There are reasonable concerns with any effort to strengthen the chip industry. The first is that our efforts may create overcapacity. The chief cause of the chip shortage was a miscalculation by companies, in particular, car companies. They, like many others, failed to plan for the surge of pent-up demand as the pandemic waned and cancelled chip orders. In response, chip makers shifted from producing for cars to producing for items suddenly in demand during the pandemic, those that supported streaming, gaming, computing and phones. This miscalculation was reinforced by supply chain disruptions from weather and fire. Just-in-time supply left car makers with no reserves, and one question for reliance is whether and how to incentivize companies to move away from just-in-time supply. The 100 Day Review's recommendation for better information flows can reduce the risk of future miscalculation, as more information on the market can guide federal and private investment in production capacity. Overproduction in chips is not a long-term problem, as demand for semiconductors will continue to grow and absorb increased capacity.

A related concern is "investment in what." The digital economy is being reshaped by cloud computing, artificial intelligence, and 5G networks. Digital technologies are being reshaped and USICA recognizes changes in telecom technology that work in America's favor. 5G and open access technologies like O-RAN depend on chips and software, both areas of American strength (especially when compared to China). Telecom and chips are dynamic industries driven by demand for better performance. The pace of change is rapid, and this could complicate plans for federal intervention. The semiconductor industry itself is broken into highly specialized segments and is geographically distributed. Deciding which sectors would benefit from federal support, and determining what kind of support, is an immediate task for policy. USICA, and with it the *CHIPS for America Act* and the *USA Telecom Act*, do a good job of recognizing that there is more to the industry than fabrication facilities. The issue is how best to intervene in this complex industry. An earlier success, SEMATECH, a non-profit, public private research consortium, provides useful precedents, the most important of which is to not try to have the

federal government direct research or insist on specific technologies and to ensure that the private sector has "skin in the game."

Role of the Government

The question of the role government is a long-standing debate in industrial policy, which we can simplify as a debate between those who argue that governments should supply the foundation for innovation through R&D funding, increased STEM education, and balanced regulation, and those who would prefer a more directive approach. The well-known case of Solyndra became the poster child for why the government should refrain from selecting a specific technology company to support, and instead emphasize market competition to identify the most successful paths forward.

Few government agencies can act like venture capital firms, something that proves to be very hard to do. Venture capital firms have a higher tolerance for risk and ring specialized expertise to identify opportunities, including using geographic proximity to markets to gain a deeper knowledge of the business. There is a mismatch between bureaucracy and innovation. There are a few examples of success for the federal government, such as In-Q-Tel and the Defense Innovation Unit (DIU), and it would help build resilience if these and similar efforts were better funded and, in DIU's case, given increased and more flexible authorities to invest.

These difficulties should not distract us from the importance of the federal government playing an essential role in creating new technology. That role has changed given the immense expansion of commercial innovation. The center of gravity for innovation and tech investment has moved away from government. A dynamic private sector innovation ecosystem is focused on commercial markets, but with the right authorities, funding, and mechanisms, the government can take advantage of this to improve resiliency. This will require some effort because the cultures are vastly different. Private sector investments dominate R&D budgets for new technologies, such as 5G, artificial intelligence, biotechnology, quantum computing and alternative power sources. The new innovation ecosystem is shaped by market signals on investment risk and returns more than policy.

Commerce and other agencies need to predict, not react. For example, media reporting recently highlighted problems with the supply of lumber. This is perhaps a good example of why media reporting is not always a useful guide for policy. The shortage was so short lived that the efforts to remedy it barely begun before it was over. It needs better analytical capabilities, clarity in roles and responsibilities, and close engagement with the private sector at senior levels to anticipate market and tech trends. Its industrial analysis and support function (a legacy from World War II) atrophied over the past decades and now needs to be rebuilt to focus on high-tech. A focus on emerging technologies can help avoid wasteful spending of time and money.

Cost

There are concerns over the cost of these initiatives, but critics of the price tag should consider two factors. First, China has been willing to spend for sustained periods of time to gain technological advantage. In some areas, China is keeping pace with the U.S. and even

outspending it in some cases. In semiconductors, for example, it has pledged more than $50 billion in five years from national funds and an equivalent amount from local governments. Given how much larger U.S national income is compared to China, this should not be the case. We should not expect to outcompete China without increased federal spending. Second, this spending is an investment, a down payment on America's technological future. Money appropriated now will create jobs and income, more than repaying the cost. Both security and economics call for the full appropriations to support the objectives laid out in USICA. Putting aside the collateral benefits to wealth creation and economic growth from USICA (and these could be substantial), it is better to overspend and stay ahead of China than to under-spend and fall behind.

A Global Approach

One advantage we have over China is that we have allies. A supply chain that involves allies increases resilience by diversifying sources. We benefit economically and strategically from an allied approach. It may seem counterintuitive, but international cooperation makes America more competitive.

Artificial intelligence (AI) exemplifies how international today's innovation base is. The technologies behind AI are not easily controlled. China has significant strength in this, but AI depends on a globally distributed R&D and innovation chain, with key nodes not only in the U.S. and China, but in Canada, the UK, Israel, Germany, and a few others. These countries share a growing distrust of China's intentions and policies that the U.S., by working with them, can capitalize upon to build security and growth. Focused federal investments and multinational partnership structures, and revised authorities can provide the U.S. real advantage in the competition with China.

The United States has used industrial policy in every major conflict since 1860. Industrial policy is part of the reason for its success in these conflicts. The U.S. must, as it has done the past, strengthen strategic industries. This is why USICA and its implementation are so important. Industrial policy was the key to helping the U.S. win those conflicts, and the technology base built in World War Two—and expanded tremendously for the Cold War—still provides foundational benefits to our economy from investments made decades ago.

We and our allies are again confronted by authoritarian states. The terms of conflict with these hostile powers will be different, relying less on military force and more on economic and political influence. One key area for competition will be in the fields of technology and business. These provide the countries that lead in them with power and authority in the international environment. A new industrial policy is necessary again for the United States, but we will need to adjust to this new form of conflict and to the changes in research and industry that have taken place over the last thirty years. That means a new, high-tech industrial policy cannot focus on building weapons and it cannot be over-managed by Washington.

China has many weaknesses that its propaganda seeks to obscure. It faces immense problems, but under its current leadership, it intends to displace the United States. Building globally dominant high-tech industries is a part of this strategy. The U.S. must respond to China's

hostility, but we can no longer rely on market forces alone to advance the national interest. Defensive actions alone will not suffice. These themes all point to the need for a renewed industrial strategy, but it cannot simply duplicate previous policies because we are now in a world where the private sector leads. This means the task for USICA implementation is to find where government intervention can best support a multinational commercial innovation base. Finding the right balance of the role of government will be difficult, but USICA, Executive Order 14017 and the 100 Day Review means that we are off to a good start.

I thank the Committee for the opportunity to testify.