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MADE IN CHINA 2025 AND THE FUTURE OF AMERICAN INDUSTRY

HEARING

BEFORE THE

COMMITTEE ON SMALL BUSINESS AND ENTREPRENEURSHIP UNITED STATES SENATE

ONE HUNDRED SIXTEENTH CONGRESS

FIRST SESSION

FEBRUARY 27, 2019

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MADE IN CHINA 2025 AND THE FUTURE OF AMERICAN INDUSTRY

WEDNESDAY, FEBRUARY 27, 2019

UNITED STATES SENATE,
COMMITTEE ON SMALL BUSINESS
AND ENTREPRENEURSHIP,
Washington, DC.

The Committee met, pursuant to notice, at 2:28 p.m., in Room 428A, Russell Senate Office Building, Hon. Marco Rubio, Chairman of the Committee, presiding.

Present: Senators Rubio, Risch, Ernst, Young, Kennedy, Romney, Hawley, Cardin, Cantwell, Shaheen, Coons, and Hirono.

OPENING STATEMENT OF HON. MARCO RUBIO, CHAIRMAN, A U.S. SENATOR FROM FLORIDA

Chairman RUBIO. Today's hearing on the Senate Committee on Small Business and Entrepreneurship will come to order.

I want to thank all of you for being here and really thank our witnesses for being a part of this today.

The title of the hearing is "Made in China 2025 and the Future of American Industry," and it is really applicable, given both conversations going on about the trade issues, but also the impact that it has on small businesses, more importantly, just the huge impact that global trade can have on small business and huge disruptions in trade and changes in those dynamics it can have on small businesses.

When the history of this century is written, I believe that one of the defining factors, if not the defining factor, will be the relationship between the United States and China on multiple fronts.

We see a threat to American competitiveness that is unprecedented in recent memory and recent history from an all-of-government approach that we see from China. We have not encountered anything like this, as I said, but unlike our previous competitors, they have developed tremendous commercial power that they have been able to use against American interests across the world.

While the challenge we face with the Chinese government is ultimately one of national security and more fundamentally about whether or not in the future of the world, whether the future of the world will be marked by authoritarianism, one of the most immediate concerns that we face, especially as it applies to small business, comes in the form of China's industrial policy.

Their government has a plan. It is called "Made in China 2025." It is a plan for industrial dominance in 10 key technological sectors, some of which the U.S. is the current global leader—all of

which, and these industries will set the tone for the 21st century economy.

For Chinese companies to meet the production targets that the plan sets out, their success will have to be at the expense of the United States.

To some extent, this is already happening. The initial period following China's accession to the World Trade Organization witnessed a devastation to American small- and medium-sized manufacturers in concentrated areas throughout the country, an effect that is now known as the "China Shock."

Understanding the goals of Made in China 2025, we must decide whether the shock should be allowed to expand up the value chain and across industries. I for one believe that this cannot be allowed to happen.

The Committee produced a report. It was recently released, titled "Made in China 2025 and the Future of American Industry." It lays out the challenges posed by this whole-of-society industrial plan, as well as a potential path forward to strengthen American economic security.

One thing is clear. Just as business firms compete, so do nations. Through plans like Made in China 2025, the Chinese government has set its sights on many of the high-value industries that America simply cannot afford to lose.

Through this whole-of-society strategy, the Chinese government attempts to steal and subsidize and ultimately compete its way to the top of the global production value chain. In sum, they aim to supplant American industrial leadership by any means necessary, including illegal ones.

Fortunately, our system contains intrinsic advantages that their totalitarian system does not. Our market-based economy and free society operate with an efficiency and openness that is impossible in China's command and control regime.

American freedoms and the open exchange of ideas attract talented and idealistic individuals from across the globe who contribute to the continuous building of our Nation's capabilities.

American ingenuity and innovation in combination with our political freedoms have created the world's most successful and most forward-thinking companies.

Small businesses, which support dignified work, strengthen families, and sustain communities, are particularly susceptible to the dangers of state-backed import competition. Trade normalization with China occurred with the optimistic promise of fair-market access, economic liberalization, and an improvement in Chinese political and human rights.

However, instead of opening, China took advantage by discounting international trade rules and norms to the detriment of American productive capabilities.

Chinese industrial and trade practices including large-scale subsidies, forced technology transfers, and obstructing market access to foreign firms underscore the nation's disregard for its international trade commitments.

Beyond merely breaking the rules, the Chinese government is seeking to dictate the terms and conditions of the future of global trade and to do so for their own benefit.

In the absence of a concerted American policy response, Made in China 2025 threatens to replicate the effects of China Shock on high-value capital goods, such as computers and aerospace products. It is important to note that these threats to American competitiveness are not contingent upon the total success of Made in China 2025 or any other industrial plan. Command and control central planning is a flawed economic approach with countless pitfalls and downsides.

However, as many American workers know personally, this does not mean that such an approach cannot have devastating impacts on U.S. production, jobs, and particularly U.S. small businesses.

In many important measures, China has already achieved success, capturing leading positions in global economic standings that were previously held by the United States. In order to confront this challenge, we must choose to prioritize national development, economic dynamism, and small business competitiveness.

This growth agenda entails a focus on domestic physical investment and labor market stabilization. It also means that we must enact in-kind responses to malicious Chinese trade and industrial practices.

As an economic development agency, the Small Business Administration is particularly suited to support innovation-focused production ecosystems. Programs such as the Small Business Investment Company and the Small Business Innovation Research and Small Business Technology Transfer, these serve as tools which can be used to further promote a nimble, innovative, and high-growth industrial strategy.

I look forward to engaging with the witnesses to explore the findings of our study, our report, and also their views on this and its implications for the future of American competitiveness.

And now I turn it over to the Ranking Member.

OPENING STATEMENT OF HON. BENJAMIN L. CARDIN, RANKING MEMBER, A U.S. SENATOR FROM MARYLAND

Senator CARDIN. Well, Senator Rubio, thank you very much for convening this hearing. I think it is an extremely important subject to take a look at the impact that Made in China 2025 will have on American small businesses.

I do point out that this morning, Ambassador Lighthizer, our USTR, testifying before the House Ways and Means Committee, indicated that he could not predict the outcome of negotiations between China and the United States.

Therefore, the points that our Chairman has made that we need to be prepared to act is one that I fully support. That we are going to need to take action in order to make sure we have a level playing field for American businesses.

In May 2015, the government of China released a 10-year plan known as Made in China 2025 to transform its high-tech manufacturing capabilities and achieve new breakthroughs in 10 key industries, including aerospace, biomedicine, and artificial intelligence.

China's stated goal is to be 70 percent self-sufficient in high-tech industries by 2025 and a leading manufacturing power by the year 2049, which is the 100th anniversary of the founding of the People's Republic of China.

China's aggressive strategy to dominate these emerging high-tech manufacturing sectors raise serious concerns, not just in the area of national security, but also to U.S. businesses, both large and small.

I am particularly concerned about the impact on small businesses. Small businesses, as we know, is the growth engine for jobs in America and innovation and are very much in the supply chain of many of these industries, and if there is unfair competition, small companies do not have the deep pockets. And we could lose that edge here in America of job growth and innovation.

As our Chairman wrote in his recent report on the subject—and I really do applaud our staff and our leadership for the report, Made in China 2025, our Chairman said, "If Made in China 2025 is successful, what the China Shock did to domestic U.S. productions of electronics, furniture, plastic, metals, and vehicle parts could threaten to be repeated itself in capital goods like machinery, automobiles, high-end computers, rail, and aerospace products."

The United States and American workers are willing to compete in the global marketplace, but that competition must be on a level playing field, where all nations are willing to follow agreed-upon international rules and standards.

I am concerned that to achieve its goal, China will rely not on innovation and ingenuity, but instead on its ongoing practice of stealing U.S. technologies and other unfair trading practices.

The administration's investigation into Chinese trade practices found four major methods by which China attempts to coerce or steal U.S. intellectual property. First, China uses investment restrictions and licensing procedures to require or pressure technology transfer. Second, China imposes restrictions and intervenes in U.S. firms' investments and activities, often leading to technology licensing terms that unfairly favor Chinese firms. Third, China directs and facilitates the acquisition of U.S. companies and assets to obtain cutting-edge American technology; and fourth, China orchestrates state-sponsored cyber theft to gain access to critical U.S. intelligence property.

I recently joined six Senators in a letter to President Trump asking him to extract meaningful commitments from China on each of these elements and to end the threats that these policies pose to the U.S. economy and national security. And while I hope the President is successful, I am disappointed by his go-it-alone negotiating style in the state for our closest allies.

As Bonnie Glaser, one of our witnesses today, wrote in the New York Times, "Alliances should be at the core of the U.S. strategy to effectively compete with rising China." Until Washington heeds this advice, Beijing will continue to exploit the opportunities that are falling into its lap.

I welcome all of our witnesses today, and I look forward to our discussion on this extremely important subject.

Chairman RUBIO. Thank you to the Ranking Member.

And now I would like to welcome our panel of witnesses. Brad Setser is a Senior Fellow for International Economics at the Council on Foreign Relations. He previously served in the U.S. Department of Treasury as Deputy Assistant Secretary for International Economic Analysis. In addition, he was the director for Inter-

national Economics, serving jointly on both the National Economic Council and the National Security Council.

Robert Atkinson is the president of the Information Technology and Innovation Foundation, a public policy organization that promotes policies based on innovation economics. He served in three previous administrations and as project director at the former Congressional Office of Technology and Assessment.

Andrew Rush of Jacksonville, Florida, is the president and CEO of Made in Space, Inc., a company which specializes in producing additive manufacturing capabilities for use in outer space and other extreme environments.

Bonnie Glaser is a Senior Advisor for Asia and the director of the China Power Project at the Center for Strategic and International Studies. Prior to her time at the Center, she consulted for a number of U.S. Government agencies, including the State Department and the Department of Defense.

Thank you all for coming today. We will begin with you, Mr. Setser.

STATEMENT OF BRAD SETSER, SENIOR FELLOW, COUNCIL ON FOREIGN RELATIONS

Mr. SETSER. I want to thank the members of the Committee for the invitation to testify here today.

I also want to commend the Committee and its staff for their recent report on China's industrial policies.

I share the report's conclusion that a vibrant advanced manufacturing sector is critical to a strong American economy, and that Made in China 2025 poses a challenge to many American businesses, to U.S. trade policy, and the rules now governing the global trading system.

The policies outlined in China 2025 are troubling not because China is looking to strengthen its own development. Rather, they are troubling because they appear to mobilize the substantial financial capacity of China's state to back a strategy of substituting domestic products for imported goods and technology.

China's government often effectively can guarantee a captive market for Chinese producers, while informally constraining, if not walling off, foreign firms from full access to China's market.

They are troubling because China's government appears to have sought to accelerate China's technological development by subsidizing the purchase of leading-edge global firms with state funds, and in some cases, supporting efforts to steal technology from foreign firms.

It is not yet clear how much progress was made on these issues in the current round of trade negotiations. I suspect that it will be difficult to negotiate an agreement that completely addresses the concerns that China's party state is uniquely able to rig China's domestic market.

I would also note that as China increasingly aims to supply the capital goods, central to the technological backbone of a modern economy, security considerations are bound to have a bigger impact on our economic relationship.

I want to focus the remainder of my testimony on two points; first, the importance of a fairly valued Chinese currency to a bal-

anced commercial relationship and then turn to the specific challenges posed by China's import-substituting industrial policies.

First, currency. Before the global crisis, there was a credible argument that ending China's currency manipulation on its own would do much to bring better balance to our trading relationship. Today, currency intervention is not the primary way Chinese policy distorts global competition.

In fact, after the dollar appreciated in 2014, China has more often intervened to keep the yuan from depreciating and to block its appreciation, but it is worth remembering that the value of China's currency remains central to the character of our commercial relationship.

The U.S. has benefited from China's domestic stimulus, which helped China pivot away from excessive reliance on exports, but there is now concern that the reduction in China's external surplus after the global crisis was based on an unsustainable expansion of credit. Putting the reduction in China's overall surplus on a sustainable footing needs to be a major U.S. policy priority.

China still saves too much and consumes too little. It often taxes low-wage work too heavily, while leaving capital income largely untaxed. To echo the words of the Senate Committee report, China also needs a policy agenda that does more to meet the needs of working families.

I will not review in detail the various ways China rigs its domestic market to support its manufacturing development. I do want to note that I support the call for stronger screening of inward Chinese investment and would even support limits on Chinese investment in certain sectors as a means of putting additional pressure on China.

I also support proactively preparing dumping and countervailing duty cases against those sectors targeted in China 2025 and preparing to file more legally difficult adverse effect WTO cases.

I also believe that the United States should be ready to match China's export financing to balance the competitive landscape in third-party markets.

Chairman RUBIO. I apologize for interrupting. If you could move the mic. I have been told people on C–SPAN are watching, but they do not know what you are saying, and the closed caption guy is going nuts.

Mr. SETSER. There we go. I apologize.

Chairman RUBIO. Can you start from the beginning? I am kidding.

[Laughter.]

Mr. SETSER. I think my time has expired, unfortunately. So my testimony, therefore, will remain in the dark.

[The prepared statement of Mr. Setser follows:]

Testimony of Brad W. Setser
Steven A. Tananbaum Senior Fellow for International Economics, Council on Foreign Relations

Before the Senate Committee on Small Business & Entrepreneurship
Hearing on Made in China 2025 and the Future of American Industry

February 27, 2019

I want to thank Chairman Rubio and Ranking Member Cardin for the invitation to testify today.

I also want to commend the Committee and its staff for their recent report on the challenges to American businesses and workers posed by China's industrial policies, including Made in China 2025.

I share the report's conclusion that a vibrant advanced manufacturing sector is a critical part of a strong American economy, and that the policies that China is pursuing to support the development of the sectors identified as priorities in Made in China 2025 are troubling. They pose a challenge to many American businesses, to U.S. trade policy, and to the rules now governing the global trading system. As the Chamber of Commerce has noted, "[Made in China 2025] is a ten-year comprehensive blueprint aimed at transforming China into an advanced manufacturing leader...in concert with the 13th Five-Year Plan...and other state-led development plants, [Made in China 2025] constitutes a broader strategy to use state resources to alter and create comparative advantage in these sectors."[1]

As China develops, the sources of China's comparative advantage will naturally evolve. It is unrealistic to expect that China—or any other country—would aspire only to conduct assembly work for companies based in other countries. The policies outlined in China 2025 are troubling not because China is looking to support its own development and strengthen its technological base, but because they appear to mobilize the substantial financial capacities of China's state to back the development of sectors where China is now a substantial importer of the rest of the world's goods. These policies are particularly troubling because China's state has a unique capacity to tilt its domestic market toward preferred firms. Through its influence over the purchases of large state-enterprises, China's government can effectively guarantee a large captive domestic market for Chinese producers while informally constraining, if not walling off, foreign firms from full access to China's market. And they are troubling because China's government appears to have sought to accelerate China's technological development by subsidizing the purchase of leading-edge global firms with state funds, and in some cases, supporting efforts to steal technology from foreign firms.[2]

The manufacturing sectors identified for preferential development in China 2025 account for roughly $50 billion of U.S. exports to China—or about a third of all goods exports to China and Hong Kong and about a quarter of total exports of goods and services to China and Hong Kong. Aircraft, integrated circuits, agricultural and construction equipment, and high-end medical equipment are all significant

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[1] "Made in China 2025: Global Ambitions Built on Local Protections," U.S. Chamber of Commerce, 2017, https://www.uschamber.com/sites/default/files/final_made_in_china_2025_report_full.pdf.
[2] Chuin-Wei Yap, "Taiwan's Technology Secrets Come Under Assault From China," *Wall Street Journal*, July 1, 2018, https://www.wsj.com/articles/taiwans-technology-secrets-come-under-assault-from-china-1530468440 and Paul Mozur, "Inside a Heist of American Chip Designs, as China Bids for Tech Power," *New York Times*, June 22, 2018, https://www.nytimes.com/2018/06/22/technology/china-micron-chips-theft.html.

components of America's industrial base. As the committee report notes, U.S. exports in these industries are supported by deep domestic supply chains that sustain many small businesses and U.S. jobs.

It is certainly worthwhile to seek to address some of the concerns raised by Chinese industrial policies through the current round of trade negotiations.

But it is still unclear how much progress will be made in the negotiations, as some of the most important distortions are deeply rooted in the nature of China's economic and political system. It will be difficult, in my judgement, to negotiate an agreement that completely addresses the concern that China's state is uniquely able to "rig" China's domestic markets in ways that discriminate against foreign firms so long as China's party-state directly controls much of the commanding heights of China's domestic economy, and so long as there is a sense that China's largest private firms can only remain successful and private with the support of the party and China's government.[3]

As Daniel Rosen of Rhodium Group and Scott Kennedy of CSIS have argued, the United States' "commercial relationship with China must be bounded both by fairness and the expanding needs of national security."[4]

I want to focus on two points in particular: 1) the importance of macroeconomic balance and a fairly valued Chinese currency to a balanced overall commercial relationship and 2) the specific challenges posed by China's import-substituting industrial policies.

But it bears repeating that trade with China—measured in the most expansive way—is around 4 percent of U.S. GDP. The overall impact of China on the U.S. economy increases somewhat after taking into account competition between the United States and China in other markets. There should be little doubt that the economic future of the United States will be determined far more by the policy choices we make here in the United States than by our ability to influence the economic and commercial policies adopted in Beijing.[5]

Currency and Macroeconomic Balance

The initial China shock—the loss of jobs in many manufacturing communities associated with the rise in imports from China that followed China's WTO accession—was not the product of the Chinese industrial policies that are the focus of today's hearing.

It stemmed from the end of the uncertainty about U.S. tariffs created by the annual vote on extending China's access to the U.S. market on standard terms, liberalizing reforms undertaken by China that

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[3] Mark Wu, "The 'China, Inc.' Challenge to Global Trade Governance," *Harvard International Law Journal* 57, no. 2 (Spring 2016), http://www.harvardilj.org/wp-content/uploads/HLI210_crop.pdf.

[4] Daniel Rosen and Scott Kennedy, "Building a Better Deal with China," *Center for Strategic and International Studies*, January 28, 2019, https://www.csis.org/analysis/building-better-deal-china.

[5] Total goods and services exports to China and Hong Kong totaled 1.2 percent of U.S. GDP in 2017; total imports of goods and services totaled 2.8 percent of U.S. GDP. 2018 should be broadly similar, though exports are likely to slip as a result of China's soybean tariffs and other retaliatory measures. As a share of GDP, U.S. trade with China has been nearly constant over the last five or six years.

increased its competitiveness, and the distortions created by China's peg to the dollar and its heavy intervention in the foreign exchange market to limit the appreciation of China's currency.[6]

At its peak, China was running a current account surplus of 10 percent of its GDP—and adding over 12 percent of its GDP to its reserves. China's actual intervention was even larger, as China's state banks were also adding to their foreign assets at the time.[7] Such intervention kept the yuan undervalued by as much as 30 percent, and likely added well overall $100 billion dollars to China's overall trade surplus. It was a mistake not to make use of the special safeguards negotiated as part of China's WTO accession—the special 421 safeguard[8]—to mitigate the impact of China's undervalued currency on the U.S. manufacturing sector and the small businesses that the U.S. manufacturing sector supported. Claims that there were no import surges that met the criteria for the 421 safeguard protection are not credible; overall imports from China were at the time growing by around 20 percent a year, and careful analysis indicates—contrary to the assertion of some—that these imports did not primarily displace imports from other Asian economies.

Before the global crisis, there was a credible argument that ending China's currency manipulation on its own would do much to bring better balance into the trading relationship with China. Today, currency intervention is not the primary way Chinese policy distorts global competition—in fact, after the dollar appreciated significantly in 2014, China has more often intervened to keep the yuan from depreciating than to block its appreciation.

The challenges posed by China are consequently in some ways more complicated now, as they stem less from policies that have promoted China's exports and more from policies that have distorted competition inside China. But it is worth remembering that the value of China's currency remains central to the character of the commercial relationship between the United States and China—and has a bigger impact on the conditions facing most American small businesses than most Chinese industrial policies. A stronger yuan encourages firms to produce more in the United States, and to source less from China. A weaker yuan by contrast helps lower the costs of those businesses that have built their operations around low-cost Chinese supplies.

The United States has on net benefitted from the adjustments that China undertook after the global financial crisis that reduced its overall current account surplus and reduced its reliance on exports. U.S. imports from China grew at about one quarter of their pre-crisis pace from 2011 to 2016. But there are real concerns that some of the policies China used to pivot toward domestic demand are themselves unsustainable, as they hinge on heavy investment by now heavily indebted local governments and rapid growth in credit to state firms. Putting the reduction in China's overall external surplus on a more sustainable footing by encouraging policies that reduce China's excessive national savings rate should be a U.S. policy priority. Without such changes, I worry that China will eventually find the temptation to allow its currency to weaken to support a pivot back to an export-based growth model irresistible.

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[6] C. Fred Bergsten and Joseph E. Gagnon, "Currency Conflict and Trade Policy: A New Strategy for the United States," *Peterson Institute for International Economics*, June 6, 2017, https://piie.com/system/files/pr_currency_conflict_002.pdf.
[7] Brad W. Setser "China's WTO Entry, 15 Years On," January 18, 2017, *Follow the Money*, https://www.cfr.org/blog/chinas-wto-entry-15-years.
[8] Robert E. Lighthizer, "Evaluating China's Role in the World Trade Organization Over the Past Decade," Testimony Before the U.S.-China Economic and Security Review Commission, June 9, 2010, https://www.uscc.gov/sites/default/files/6.9.10Lighthizer.pdf.

Because reducing China's high savings rate is now essential to preserving China's domestic macroeconomic equilibrium, expanding China's system of social insurance may be almost as critical to the long-term health of the Chinese-American commercial relationship as are changes in China's industrial policies. [9] China, with a low level of household consumption relative to the size of its economy and relatively high taxes on formal work, also needs a policy agenda that does more "to meet the needs of working families."

The Challenge Posed by Made in China 2025

China has recognized that the Made in China 2025 industrial plan has created frictions in its relations with a number of countries, not just the United States, and is reportedly in the process of rebranding its industrial policies. But the basic policy thrust behind China 2025 hasn't changed—China still aims to build up its domestic industries in a set of strategic sectors through a combination of state subsidies and domestic preference for "indigenous" production and firms and in some cases selective application of competition law and using the standard setting process to favor national firms.

The sectors identified in Made in China 2025 are at the heart of the United States' advanced manufacturing economy. The civil aircraft industry is, by far, America's leading export sector. It alone easily accounts for over 10 percent of all the goods the U.S. exports to China. The U.S. share of semiconductor manufacturing—actual fabrication—is more modest than it once was. [10] Yet exports of semiconductors "fabbed" in the United States are still an important U.S. export to China and Hong Kong, generating around $10 billion of U.S. exports, and circuit designs from U.S. firms account for about half of the global market. The U.S. position in the manufacture of telecommunications networking equipment also has slipped over time, but the United States continues to be a leader in many of the technologies that are central to the creation of a modern telecommunications network. Medical and agricultural equipment have long been an important part of the U.S. manufacturing base. Robotics and artificial intelligence are likely to be central to industries of the future.

China's plan to reserve a portion of China's domestic market for its own production in these sectors thus represents a clear threat to a substantial portion of current and future U.S. exports to China. It is hard to see how overall trade with China can move closer to balance if China no longer wants to import U.S. aircraft and U.S. designed chips. China buys an awful lot of soybeans, but even if it replaced all of its current imports from Brazil with U.S. production, overall U.S. exports to China would increase by only $20 billion. U.S. imports from China are now around $600 billion.

It is worth noting that the challenge China poses to American manufacturing has evolved over time. China today is increasingly designing and producing the capital goods central to the infrastructure of a technologically advanced economy, not simply assembling consumer goods for American and other multinational firms. China can now produce and export the equipment to generate and distribute electricity, whether from renewable or non-renewable sources; the handsets needed to connect to a phone network; the base stations and switching equipment needed to run an efficient telecommunications network; and the heavy machinery needed to build ports, roads, and other physical

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[9] Longmei Zhang, Ray Brooks, Ding Ding, Haiyan Ding, Hui He, Jing Lu, and Rui Mano, "China's High Savings: Drivers, Prospects, and Policies," *International Monetary Fund*, December 11, 2018, https://www.imf.org/en/Publications/WP/Issues/2018/12/11/Chinas-High-Savings-Drivers-Prospects-and-Policies-46437.

[10] Michaela D. Platzer and John F. Sargent Jr., "U.S. Semiconductor Manufacturing: Industry Trends, Global Competition, Federal Policy," *Congressional Research Service*, June 27, 2016, https://fas.org/sgp/crs/misc/R44544.pdf.

infrastructure. While in some cases China's exports of advanced capital goods still depend on access to imported foreign technology, China's growing exports in sectors central to the basic infrastructure of a modern economy necessarily mean that considerations related to security will play a larger role in our trading relationship over time.

In some specific instances, the policies that China has adopted are direct violations of the WTO's rules—and in other cases, notably in informal expectations for technology transfer to a joint venture partner in order for a firm to access China's domestic markets, China's practices clearly violate the spirit of its WTO commitments.[11]

But it is also important to note that in some cases Chinese policies aren't direct violations of the current trade rules—in part because the rules weren't really designed with expectation that the state would continue to occupy the commanding heights of one of the world's two largest economies.[12]

Subsidies to domestic industries, for example, are not a violation of China's WTO commitments. Foreign partners have the right to take action to offset the impact of specific subsidies that can be demonstrated to have a caused a material injury to their business, but not to stop the subsidies. But in China's case, proving the existence of a sector-specific subsidy that is actionable under U.S. trade law can be challenging. Any firm that can access the state banking system rather than having to rely on the informal financial system effectively gets a subsidy, particularly as China has been willing to absorb the losses that state banks incur on lending to priority sectors. In many cases, the support has been provided by government backed investment funds and development banks that notionally are state enterprises, rather than through the government budget—complicating the legal case for trade action.[13]

The need to wait for evidence of material injury effectively means that trade action is often only legally permitted after Chinese subsidies have already altered the competitive landscape of the industry. No other country can provide over $50 billion to national funds that support the development of the semiconductor sector—and also provide an additional $100 billion in support from multiple provincial funds.[14] China's state enterprises, backed by these funds, are making large investments in semiconductor manufacturing capacity that could drive down prices—and then the state funds could help China's new national champions acquire their foreign competitors and their technology.

China's large subsidies for strategic sectors gain additional potency because of how they interact with China's capacity to put pressure on its leading firms to substitute domestic production for imports. For example, China is clearly seeking to leverage Huawei's leading position in the telecommunications industry to strengthen its domestic semiconductor manufacturing industry. Germany's Mercator Institute noted "Chinese high-tech industries, in particular the national champions, are expected to

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[11] "Findings of the Investigation into China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation Under Section 301 of the Trade Act of 1974," *Office of the United States Trade Representative*, March 22, 2018, https://ustr.gov/sites/default/files/Section%20301%20FINAL.PDF.
[12] Wu, "The 'China, Inc.' Challenge to Global Trade Governance".
[13] Jennifer Hillman, "The Best Way to Address China's Unfair Policies and Practices is Through a Big, Bold, Multilateral Case at the WTO," Testimony Before the U.S.-China Economic and Security Review Commission, June 8, 2018, https://www.uscc.gov/sites/default/files/Hillman%20Testimony%20US%20China%20Comm%20w%20Appendix%20A.pdf.
[14] Bob Davis and Eva Dou, "China's Next Target: U.S. Microchip Hegemony," *Wall Street Journal*, July 27, 2017, https://www.wsj.com/articles/chinas-next-target-u-s-microchip-hegemony-1501168303.

acquire the capabilities to create independent innovative technological solutions and replace their foreign competitors on the domestic market and increasingly also on global markets." [15]

The civil aviation industry provides the best example of how China potentially can leverage the states' broad role in the economy to discriminate against imports. China now account for about 20 percent of total global aircraft demand. All of the major Chinese airlines are effectively state controlled, and can tilt their future purchases toward China's own nascent civil aviation industry (Hainan airlines is privately-owned, but its leveraged parent—HNA—now relies on state backing.)[16] China is not a signatory to the WTO's government procurement agreement, and such purchases would not be covered by the procurement agreement in any case (most purchases by state firms are considered commercial not governmental purchases).

The market structure in sectors like railway equipment and telecommunications networking equipment is similar to that of the aircraft industry: China's central government owns the companies that account for the bulk of Chinese demand. In other sectors, such as medical equipment, selling into the Chinese market requires navigating multiple procurement lists, including provincial procurement lists for devices eligible for reimbursement by public insurance. China's government has indicated that it wants to raise China's share of the domestic hospital market to 50 percent by 2020, and 70 percent by 2025.[17]

As Mark Wu of Harvard Law School has argued, China—and the Chinese Communist Party—possesses a set of policy levers that impede the ability of U.S. and other firms to successfully export to China yet are hard to counter through standard trade tools. Chinese imports of manufactures have consistently grown more slowly than China's own economy; they are now a smaller share of China's economy than they were prior to China's WTO accession.[18] Few U.S. firms outside of the commodity sectors believe that they can successfully produce in the United States and sell large quantities to China; Boeing is more the exception than the rule.

I should note that it is particularly important for small business that the United States prioritize opening Chinese markets to U.S. exports, not just making China safe for investment by U.S.-based multinational companies. Small businesses are more likely to be able to export to China than to be able to navigate the hurdles associated with establishing a Chinese subsidiary and producing inside China. Concerns about the impact of "buy China" policies on U.S. exports would not go away even if China ended all of the informal technology transfer requirements imposed on U.S. firms seeking to invest in China. China could still give preference to foreign firms that have set up inside China over foreign firms looking to export into China.

U.S. Policy Response

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[15] Jost Wübbeke, Mirjam Meissner, Max J. Zenglein, Jaqueline Ives, and Björn Conrad, "Made in China 2025
The making of a high-tech superpower and consequences for industrial countries," *Mercator Institute for China Studies*, August 2016, https://www.merics.org/en/papers-on-china/made-china-2025.

[16] Lucy Hornby and Sherry Fei Ju, "Beijing leans on lenders to back debt-hit HNA's bond sale," *Financial Times*, June 15, 2018, https://www.ft.com/content/613379f6-70af-11e8-92d3-6c13e5c92914.

[17] Tom Hancock, "Multinationals lose ground in China's medical devices," *Financial Times*, May 27, 2018, https://www.ft.com/content/ea032bba-5f33-11e8-9334-2218e7146b04.

[18] Brad W. Setser, "China Should Import More," *Follow the Money*, November 7, 2018, https://www.cfr.org/blog/china-should-import-more.

The committee's report identified a number of potential policy responses to the Chinese industrial policies embedded in Made in China 2025 and its likely successors.

I support stronger screening of inward Chinese investment—and even outright limits on Chinese investment in certain sectors as a means of putting pressure on China to drop its most egregious industrial policies. Such restrictions on investment are generally compatible with the United States' WTO commitments. I also believe that the United States should be proactively preparing CVD and anti-dumping cases against imports in those sectors that China has targeted in China 2025, and should be ready to self-initiate such cases—and also to file more legally challenging "adverse" effects WTO cases to counter the loss U.S. firms could face on their sales in China and third-party markets. The United States should also be ready to match Chinese export financing to balance the competitive landscape in third party markets and to encourage China to sign up to international disciplines on its own export financing.

I am more leery of prohibitions on U.S. exports of critical components as a means of trying to impede Chinese industrial development. Such restrictions have a role in protecting U.S. national security and as a punishment for violations of sanctions and the outright theft of U.S. intellectual property. But if applied broadly as part of a "counter-industrial policy" strategy, they would likely reinforce China's efforts to build up its own domestic capacity across a broad range of sectors.

Many traditional U.S. allies share the United States' concerns with the trade-distorting impact of China's import and technology-substituting policies, so there also may be scope for joint action. Several U.S. allies, for example, are currently considering tightening their own restrictions on Chinese investment.

Conclusion

The United States ultimately cannot determine how China manages its own domestic economy. The policy variables under our control are our openness to investment from China—and our willingness to continue to trade with China on standard WTO terms while China acts to limit its imports from us.

China equally cannot set the conditions for competition and innovation here in the United States. The United States should not ignore Chinese policies that are adverse to U.S. economic interests, but our top priority should always be to reinforce the United States' own sources of competitive advantage. China doesn't determine how much we invest in our own infrastructure, how much support we provide for research and development, how much we invest in our own workforce, how we use the tax system to incentivize and reward low-wage work, or how we tax the international activities of U.S. multinational companies. While it is no doubt controversial, I attach particular importance to ending the provisions of the new tax code that appear to continue to reward the offshoring of intellectual property and certain factories and jobs. Rather than courting Chinese state investment, the United States should be encouraging American firms to invest more here at home. Provisions that artificially lower the tax of large multinational companies only shift the tax burden onto American small business. The committee report helpfully noted a set of policy areas where agreement might be possible even with different parties in control of the House and Senate. Policy decisions made in these areas, far more than any policy decision made in China, will determine our economic future.

Chairman RUBIO. What a great witness. Thank you, sir. I appreciate it.

Mr. Atkinson.

STATEMENT OF ROBERT ATKINSON, PRESIDENT, INFORMATION TECHNOLOGY AND INNOVATION FOUNDATION

Mr. ATKINSON. Thank you, Chairman Rubio and Ranking Member Cardin and members of the Committee. Press the button; turn the mic. It is a pleasure to be here with you.

I am not going to focus specifically on all the egregious things China is doing. We have written about that. We have heard about that today. I will say that ITIF as a think tank has been focusing on this for almost a decade. We wrote a report in 2012 with the provocative title "Enough is Enough: Confronting Chinese Innovation Mercantilism," and since then, things have not gotten any better.

I want to really discuss four major points that the Committee's report alluded to that I think are critical.

I think the development of widespread clarity and agreement on these points is one of the most important things we can do in Washington in this space. If we can agree on these major principles, getting the right action to follow is a lot easier.

First, the report highlights the need for a wake-up call when it comes to understanding the nature of the threat from China. There are still too many people in Washington who have the view that China cannot innovate; they can only copy. And I think that is false. We are already seeing that where they have gained considerable advantage in industries like jet aircraft, high-speed rails, solar panels, personal computers, super computers, telecommunications equipment, and internet services. We have to remember that people said the exact same thing about Japan in the 1960s, Korea and Taiwan in the 1970s. All three of those nations are clearly global technology leaders. There is no reason China cannot become a global technology leader.

Second, the report rightly notes that globalization, while the narrative that is dominant is that globalization can be harmful to some workers, that it is beneficial for us overall. And to be sure, two-sided free trade like trade with China, with Canada and Mexico, is welfare maximizing for the U.S., but I would argue that trade with nations like China that is premised on systemic innovation mercantilism reduces overall U.S. economic welfare, not just hurts a few individual workers or communities.

Third, the report rightly notes that it is a mistake to posit only two choices—laissez faire, free-market capitalism on one side and heavy-handed industrial policy on the other side. This was always a false choice, and as every governor in America knows, regardless of party, every single governor has an economic development strategy. Florida has one. Maryland has one. And it does not matter the party. They know that if they are not putting in place good economic development policies for their State, their State will be left behind in global competition. We have to think the same way in Washington as governors do around the country.

Finally, the report rightly notes that the choice should not be between rolling back Chinese innovation mercantilism and getting

better policies at home. We saw that recently in a Washington Post op-ed by Lawrence Summers who said—I am paraphrasing essentially—we should not worry about China; we should only do the things we have to do at home. And he got that half right. There are other people who say, well, we should only worry about China and not do things at home. We have to do both. If we do not have a good and aggressive policy to force China to comply by the rules, which, by the way, I would agree has to be alliance-based, we are not going to have the kind of success Chairman Rubio was alluding to. And if we do not have better domestic policies around innovation competitiveness, we will not.

Let me just take the last minute here to say a few things. I alluded to a number of what I thought could be promising policy changes, but let me mention a couple that relate to small business.

Right now, the SBA has, as you all know, a 7(a) loan program. Most of those loans go to companies that are in sectors that are not traded. They are going to be here, no matter what. SBA funds liquor stores. If they do not give loans to liquor stores, we are still going to have liquor stores in America. Only 7.5 percent of SBA loans go to manufacturers, and I think it is an important area to work with SBA to help them figure out how can they make sure that more of their loans and more of their assistance are going to the kinds of companies that are facing tough global competition.

Secondly, and I know this is not the Finance Committee, but there are a number of provisions in the Tax Code that are problematic for small technology startups. One is a current law regarding how passive investors can take advantage of the research and development tax credit, something I know Senator Coons is focused on. Under that law, it makes it harder for when a company is sold for those R&D credits to go with the investor, making it less valuable as a company.

Finally, Congress should, in our view, allocate, allow a small share of SBIR and STTR grants award to be used for commercialization activities. Again, Senator Coons, you had a bill on that, and we fully support that. SBIR and STTR are great programs, but unless you commercialize the technology, it is not as effective as it could be.

Finally, last idea, 10 countries now around the world, including many of our allies, have programs to provide very small vouchers, about $25,000, to give to small innovation-based companies to go to a National Lab or a Federal lab or research universities and spend it on getting technical assistance or cooperative R&D. We have advocated for a small sort of test pilot program to be run by perhaps NIST, the National Institute of Standards and Technology, and basically allow companies to give them more access to our Federal labs and our universities.

With that, I will stop and apologize for going over my time.

[The prepared statement of Mr. Atkinson follows:]

ITIF | INFORMATION TECHNOLOGY & INNOVATION FOUNDATION

Testimony of

Robert D. Atkinson
President
Information Technology and Innovation Foundation

Before the
Senate Small Business Committee

Hearing on
"Made in China 2025 and the Future of American Industry"

February 27, 2019

Washington, DC

Good afternoon Chairman Rubio, Ranking Member Cardin and members of the Committee; thank you for inviting me to share the views of the Information Technology and Innovation Foundation (ITIF) on the issue of unfair Chinese trade and technology policies and practices and what the federal government should do in response.

The Information Technology and Innovation Foundation is a non-partisan think tank whose mission is to formulate and promote public policies to advance technological innovation and productivity internationally, in Washington, and in the states. Recognizing the vital role of technology in ensuring prosperity, ITIF focuses on innovation, productivity, and digital economy issues. ITF has long focused on the issue of not only how unfair foreign policies and practices, particularly Chinese, negatively impact the U.S. economy, but why and how the federal government should establish a robust national competitiveness and innovation policy. I very much appreciate the opportunity to comment on these issues today.

In my testimony I first discuss the importance for a new framework for how to think about the economic challenge from China and the key points in this regard raised in the recent report from Chairman Rubio – "Made in China 2025 and the Future of American Industry". Second, I discuss the nature of China economic challenge from "Made in China, 2025." Finally, discuss components for more robust trade, innovation and competitiveness strategies, including components to help small businesses.

The Importance of a New Doctrine for Responding to the Economic Challenge From China

Before discussing some of the major issues vis-à-vis China's "Made in China, 2025" program, I would like to first comment on a number of major points made in Chairman Rubio's report. The report makes a number of critical points that are all too often ignored or misunderstand. The development of widespread clarity and agreement on these points is the single most important task facing the Washington economic and trade policy making community today.

First, the report highlights the need for a wake-up call when it comes to understanding the nature and extent of the economic threat from China. Until recently, the Washington trade and economic policy establishment largely turned a blind eye to the China challenge, perversely arguing either that China's unfair trade and economic practices helped the U.S. economy by keeping prices low or that the effects were inconsequential.[1] Even after China has gained global market share in a number of extremely complex, advanced technology industries like jet aircraft, high-speed rail, solar panels, personal computers, supercomputers, telecommunications equipment, and internet services, many still dismiss China's capabilities and assume China will be incapable of even partial success meeting their aggressive MIC25 goals. While mastery of some particularly complex technologies like semiconductor logic circuits remains a challenge for China, Chinese companies have made significant progress in an array of other technologies, including in some kinds of semiconductors (e.g., chips for internet-of-things devices). Moreover, the fact that nations like Japan in the 1960s and 70s and Taiwan and South Korea in the 1980s and 90s could rapidly progress to become advanced technology economies suggests that there is nothing inherently keeping a nation like China from making similar progress, especially given the massive amount of government support for the effort.[2]

Second, the report rightly notes that globalization can be harmful not just to some U.S. workers, but to the U.S. economy overall if it is based on unfair, predatory trade practices. Yet, the

Washington trade and economics community persists in advancing a narrative that while trade may hurt some workers, regions, firms or industries, overall it is a net positive for the U.S. economy as a whole. Many even argue that one-sided free trade, where America obeys the rules and our competitors do not, is still welfare maximizing. This is wrong. To be sure, two-sided free trade – like trade between Mexico, Canada and the United States – is welfare maximizing for the United States, but trade with nations like China, whose entire trading system is based on "innovation mercantilism," reduces U.S. economic welfare. Foreign mercantilist trade practices, especially those designed to challenge America's core competitive advantage in higher-wage, innovation based industries harm not just a few "losers" from trade, but the entire U.S. economy. Thus, as the Rubio report rightly calls for, it is time to move "beyond the false choices poised about economic growth and trade." For too long, the Washington trade community established set up a Manichean choice: one was either for free trade or protectionism. In fact, one can and should be for free trade and against foreign protectionism.

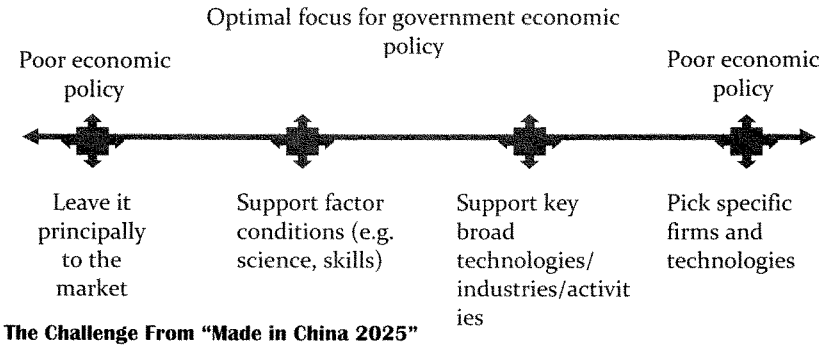
Third, the report rightly notes that it is a mistake to posit only two choices: laissez faire, free-market capitalism vs heavy-handed "industrial policy". This choice was always a false one, but never more so than now. For U.S. governments (local, state or federal) to help companies in the United States, particularly in advanced industries, compete globally, especially against China, does not necessarily imply, as some on the right claim "inappropriate industrial policy" or as some on the left would claim wasteful "corporate welfare". The reality, as every U.S. governor knows, regardless of political party affiliation, is that jurisdictions are now in intense competition for advanced industries, and that governments have to play a supportive role or risk losing those industries and the good jobs that come with them. Therefore prioritization of the high-wage industries of the 21st century, as the report calls for, is not some kind of statist, misallocation of resources, but rather needs to be a core component of 21st century statecraft, one that the Washington economic policy community sorely needs to improve its understanding of and capabilities for.

Because this point of the appropriate role for government is so poorly understood and even actively opposed by many in the economic policy community, it's worth elucidating it. Notwithstanding the efforts of rigid free-market economists to blur the differences between smart industrial policy and heavy-handed, distorting industrial policies, there are real differences. To illustrate this, it is useful to envision a continuum of government-market engagement, increasing from left to right in four steps: from (1) a "laissez-faire, leave it to the market" approach; to (2) "supporting factor conditions for innovation;" to (3) "supporting key broad technologies/industries"; to (4) "picking specific technologies/firms" (for example, supporting ABC Widget company as a national champion and picking XYZ kind of battery technology, rather than storage technology generally) (see figure 1). Only the last type of actions qualify as inappropriate "industrial policy." As the Rubio report points out there is a range of activities between these two poles that governments can and should take to spur innovation and competitiveness.

Finally, the report rightly notes that the choice should not be between working to roll back Chinese innovation mercantilism and spurring more innovation and productivity at home. Some

who resist taking firm steps against Chinese policies and practices argue that only the latter is needed. Others who eschew a stronger federal rule in spurring competitiveness, including support for the public investment that must accompany that policy, argue that getting touch with China is enough. The reality is that the federal government will not restore the promise of the American dream if it does just one or the other. It must do both: roll back Chinese innovation mercantilism and put in place a robust national innovation and competitiveness policy.

Figure 1: Continuum of Government Market Engagement



The Challenge From "Made in China 2025"

Today the United States leads in the fifth industrial [illegible] n technology) and hopes to lead in the sixth (artificial intelligence, robotics, biotechnology, etc.), but a major threat to our leadership is from China's unfair and harmful trade and technology policies. China is seeking global technology dominance in an array of advanced technology industries through an unprecedented array of predatory economic and trade policies and practices. The world has never seen a country like China before, with its organized and strategic system of authoritarian state capitalism and massive scale. It is not a market economy where private sector firms largely dictate their own strategy and actions. It is not a country governed by the rule of law. It is not a country constrained by global norms of acceptable economic and trade behavior. It is a country where the government is concerned with one and only one economic goal: winning in advanced technology industries by any means possible.

As ITIF has documented across a series of reports—including "False Promises: The Yawning Gap Between China's WTO Commitments and Practices," "Enough is Enough: Confronting Chinese Innovation Mercantilism," and "Stopping China's Mercantilism: A Doctrine of Constructive, Alliance-Backed Confrontation "—China has deployed a vast panoply of innovation mercantilist practices that seek to unfairly advantage Chinese advanced-industry producers over foreign competitors.[3] These practices have included forced technology transfer and forced local production as a condition of market access; theft of foreign intellectual property (IP); curtailment and even outright denial of access to Chinese markets in certain sectors; manipulation of technology standards; special benefits for state-owned enterprises; capricious cases to force

foreign companies to license technology at a discount; government subsidies of Chinse companies, and government-subsidized acquisitions of foreign enterprises. U.S. and foreign enterprises across virtually every advanced technology sector—from aerospace and biotechnology to information and communications technology (ICT) products, Internet, clean energy, and digital media—have been harmed by China's aggressive use of these types of innovation mercantilist policies and will continue to be harmed if China cannot be pressured to roll back its egregious predatory practices.

In the last few years, though, the focus of China's efforts has shifted. In 2015, Chinese President Xi Jinping unabashedly trumpeted a goal of making China the "master of its own technologies."[4] China's arrival at that point resulted from the evolution of Chinese economic policy over the past two decades. Up to the mid-2000s, China's economic development strategy sought principally to induce foreign multinationals to shift relatively low- and moderate-value production to China.[5] It used an array of unfair tactics, including currency manipulation, massive subsidies, and limits on imports. As ITIF and others such as MITs David Autor have shown, the cost the United States millions of manufacturing jobs.[6] However, that strategy changed in 2006 as China moved to a "China Inc." development model of indigenous innovation which focused on helping Chinese firms, especially those in advanced, innovation-based industries, often at the expense of foreign firms. Marking the shift was a seminal document called the "National Medium- and Long-term Program for Science and Technology Development (2006-2020)," which called on China to master 402 core technologies, everything from intelligent automobiles to integrated circuits and high-performance computers.

In recent years President Xi has doubled down on this approach, through new promulgations such as the "13th Five-Year Plan for Science and Technology," the "13th Five-Year Plan for National Informatization," "The National Cybersecurity Strategy," and of course, the "Made in China 2025 Strategy," As the Mercator Institute for China Studies in Germany writes, "Made in China 2025 in its current form [means that] China's leadership systematically intervenes in domestic markets so as to benefit and facilitate the economic dominance of Chinese enterprises and to disadvantage foreign competitors."[7] For instance, with regard to ICT-enabled manufacturing the strategy calls for 80 percent domestic market share of high-end computer numeric controlled machines by 2025; 70 percent for robots and robot core components; 60 percent for big data; 60 percent for IT for smart manufacturing; and 50 percent for industrial software.[8]

Unfair Policies and Practices Underpin "Made in China 2025"

At the heart of China's strategy is foreign technology acquisition. The Chinese leadership knows that if it just relies on market forces few if any foreign technology leaders will provide them with the technology Chinese firms need. And domestic Chinese firms, while making progress, lag behind the global technology leaders. As a result, China has deployed a panoply of tools to unfairly obtain needed foreign technology. Once it obtains technology it relies on an array of tools, including protected markets and massive subsidies, to scale up and gain global market share.

Intellectual Property Theft: Intellectual property theft is an important tool in the Chinese arsenal. China has deployed industrial spies to obtain foreign secrets. As the *New York Times* documented, a leading Chinese computer chip maker allegedly paid employees of a Taiwanese chip company working with the U.S. company Micron to steal valuable chip designs.[9]

Another vector is cyber theft. Seven percent of U.S. firms operating in China listed cyber theft as a problem, a number that presumably would be higher if every firm that had faced an intrusion was aware of it.[10] The *IP Commission Report on the Theft of U.S. Intellectual Property* found that China accounted for nearly 80 percent of all IP thefts from U.S.-headquartered organizations in 2013, amounting to an estimated $300 billion in lost business annually.[11] An updated 2017 Commission report put the figure at $600 billion.[12] Then NSA Director Keith Alexander has called Chinese IP theft, "the greatest transfer of wealth in history."[13] Even though President Xi made "commitments" to end Chinese cyber-theft, there is little evidence that the Chinese have followed through on this promise. As the China the National Counterintelligence and Security Center stated in its "2018 Foreign Economic Espionage in Cyberspace" report:

> China has expansive efforts in place to acquire U.S. technology to include sensitive trade secrets and proprietary information. It continues to use cyber espionage to support its strategic development goals—science and technology advancement, military modernization, and economic policy objectives. China's cyberspace operations are part of a complex, multipronged technology development strategy that uses licit and illicit methods to achieve its goals.[14]

Meanwhile, China still has one of the highest rates of unlicensed software usage in the world, with 74 percent of the software in use unlicensed and the market value of unlicensed software usage exceeding $8.7 billion in 2013.[15] 240,000 Internet cafés in China rely on illegal copies of entertainment software.[16] Chinese firms even produce and sell technology to allow consumers around the world to circumvent encryption protection so they can pirate video games.

Another vector for purloined intellectual property is to trick companies in the United States into thinking that a Chinese firm wants to invest in them. A seemingly independent Chinese investment fund will approach a small to mid-sized U.S. technology company and indicate a willingness to invest needed capital in the company. But before the Chinese company can do this, they must do due diligence and they send in employees, who turn out to work for a state-owned Chinese company, to obtain key information about the company, including trade secrets. The firm never hears back from the investment company again.

Another path is through exchange visits and student enrollments in U.S. universities. At least at one time, it was common for Chinese exchange visitors to the United States to use opportunities to visit factories and other facilities to engage in industrial espionage, including measuring equipment, taking photos and writing detailed technical notes to bring back to China. And as Daniel Golden writes in *Spy Schools* there have been cases where Chinese graduate students enrolled in U.S. universities use their access to valuable scientific and engineering information to bring that back and provide it to Chinese companies.[17]

Chinese trade secret theft also represents an increasing challenge. A prime example is Boston-based American Superconductor (AMSC), which provides software, design, and hardware solutions for wind manufacturers and energy providers. American Superconductor's top customer, the Chinese-based wind turbine manufacturer Sinovel Wind Group, faced criminal and civil actions for paying an AMSC employee to steal proprietary power-converter and control-system software, which it then used illegally in its wind turbines to meet electricity grid standards.[18] The employee, an engineer at one of AMSC's subsidiary's, was recently found guilty of industrial espionage in Austria. In another telling case, the global agriculture firm Monsanto decided to open production and research facilities for advanced corn technology in China and proceeded to develop experimental fields growing genetically enhanced corn. It wasn't long before the advanced corn was systematically stolen, clearly an effort by the Chinese government to gain access to the IP embedded in Monsanto's corn.[19]

Weak IP Enforcement: Weak enforcement of IP law is another vector. Chinese firms can often copy and reengineer foreign technologies with impunity (what they call introducing, digesting, absorbing and re-innovating), even those technologies protected by patents. As a *MIT Sloan Management Review* article, "Protecting Intellectual Property in China," noted, "Intellectual property protection is the No. 1 challenge for multinational corporations operating in China."[20] According to the U.S. International Trade Commission, in 2009, U.S. IP-intensive enterprises conducting business in China reported losses of approximately $48.2 billion in sales, royalties, or license fees due to Chinese IPR infringement.[21] In 2018, according to the American Chamber of Commerce in China, one-quarter of surveyed U.S. companies cited "Insufficient protection offered by text of IP-related laws and regulations," while 24 percent cited, "Difficulty prosecuting IP infringements in court or via administrative measures" as significant challenges.[22]

China also favors domestic over foreign patent applicants when it comes to strategic industries. As the 2016 report "Technology Protectionism and the Patent System: Strategic Technologies in China," finds, "Foreign applications in technology fields that are of strategic importance to China (as defined by being listed on the MLP) are 4 to 7 percentage points less likely to be approved than local applications, all else equal."[23] As it notes, "Given the importance of industrial policy in China and the country's strong focus on indigenous innovation and intellectual property, the empirical results provide a case of technology protectionism by means of the patent system."[24]

State-Backed Purchases of U.S. Technology Companies: An increasingly important way for Chinese firms to gain access to needed technology is to simply buy up U.S. technology companies or invest in high-tech startups. Indeed, until recently, a not-insignificant share of Chinese foreign direct investment into the United States was in technology industries. According to Select USA, the top four industrial categories in terms of numbers of Chinese FDI projects from 2003 to 2015 were electronics, industrial machinery, software and information technology services, and communications.[25] The Rhodium Group reports that over the last 16 years there has been roughly $18 billion of Chinese FDI into ICT and electronics industries deals, with most of that in just the last few years. Of the $4.9 billion invested in electronics, $4.2 billion was invested in 2016, with 99.99 percent of that going to buy U.S. firms.[26] Of the $14.2 billion invested in ICT, 74 percent was

made from 2014 to 2016, with more than 95 percent going to acquisitions.[27] These numbers would have been considerably larger if the federal government had not informally or formally blocked some deals through the Committee on Foreign Investment in the United States (CFIUS). Fortunately, Chinese inward FDI has dramatically fallen in the last two years as it became clear that the U.S. government would take a harder look at their attempts to buy U.S. technology. And of course, the recent enactment of the Foreign Investment Risk Review Modernization Act (FIRRMA) will hopefully help even more going forward.

The role of Chinese government money in U.S. deals is underreported in part because of the opaque nature of this support. As Wang and Wang note, many Chinese firms lack transparency, making it difficult for host countries to know enough about the investing firm.[28] This was evident for example in the attempted purchase of German semiconductor equipment firm Aixtron by a Chinese investor where there were "a web of relations among the customer, the buyer, and the Chinese state."[29] Moreover, the Chinese government channels funds to supposedly private investment bodies, making it look as if these deals are commercial.

The main purpose of most Chinese technology companies buying U.S. technology companies is not to make a profit, but to take U.S. technology to upgrade their own technology capabilities. The Rhodium Group notes that in the aviation sector, "The dominant player is aviation conglomerate AVIC, which is looking to the US market to upgrade its technology and other capabilities."[30] Likewise, in the electronics and electrical equipment sector, "Chinese investors are drawn to the US electronics and electrical equipment sector for building their brands, expanding their sales and distribution channels, and upgrading their innovative capacity and technology portfolios."[31] Investments in pharmaceuticals and biotechnology are "often driven by upgrading technology (such as Wuxi's acquisition of AppTec, a laboratory services firm)."[32] As one study of Chinese FDI estimated, 30 percent of the private firm deals and 46 percent of the SOE deals are motivated by technology acquisition.[33] The authors go on to state that Chinese acquisition of overseas firms "has become the most widely used methods [of investing overseas] for Chinese firms, largely because it provides rapid access to proprietary technology."[34]

China has also ramped up its efforts to buy into early-stage U.S. technology start-ups. A recent report from DOD's Defense Innovation Unit Experimental (DIUx) finds that "Chinese participation in venture-backed startups is at a record level of 10-16% of all [U.S.] venture deals (2015-2017) and has grown quite rapidly in the past seven years."[35] And some of this investment comes from venture firms that are backed by Chinese governments (federal or provincial). For example, the Zhongguancun Development Group, a state-owned enterprise headquartered in Beijing has set up "Danhua capital" to promote the strategy of "Zhongguancun capital going global and bringing in overseas advanced technology and talents."[36] Likewise, Shenzen Capital Group, a purportedly private venture capital firm that has invested in at least one advanced U.S. technology company,[37] has actually received about 80 percent of its invested capital from the Chinese government,[38] and its investments are focused, not surprisingly, to match the central governments key targeted industries. The firm even boasts a chart that compares the technology allocation of its investments and how it compares to the governments priorities.[39]

FDI acquisition is not the only path to U.S. technology capabilities. For example, China is investing in U.S. research universities to gain access to their research, often with U.S. state government-backing. For example, Maryland is committing nearly $600,000 over three years to build up the Maryland International Incubator, in a bid to attract high-tech companies from China and elsewhere to collaborate with University of Maryland researchers. Of the 18 companies in the incubator, nine are from China, with most of these being biotech companies.[40] In addition, Chinese firms have become investors in early stage U.S. technology companies. These include the venture capital arms of Chinese Internet companies such as Alibaba or Tencent. The idea is to invest in start-ups and use that as a way to bring technology and knowledge back to China. Indeed, at least a few Silicon Valley experts report that they are seeing a significant uptick in Chinese venture investment in Silicon Valley. In just the first three months of 2018, Chinese-based venture-capital funds invested $1.4 billion into U.S. biotechnology companies.[41] This trend could very well increase in coming years as China sees that its traditional acquisition route becomes more difficult. We see this pattern in other nations as well. 40 percent of venture capital in Israel in 2015 reportedly came from China.[42]

Forced Technology Transfer: Dwarfing these tools is forced technology transfer. Although China's World Trade Organization (WTO) accession agreement contains rules constraining it from tying foreign direct investment or market access to requirements to transfer technology to the country,[43] China routinely requires firms to transfer technology in exchange for being granted the ability to invest, operate, or sell in China.[44] As Harvard Business School professors Thomas Hout and Pankaj Ghemawat document in "China vs the World: Whose Technology Is It?," Chinese technology transfer requirements as a condition of market access have affected scores of companies in industries as diverse as aviation, automotive, chemicals, renewable energy, and high-speed rail.[45] To be sure, because such conditions usually contravene China's WTO commitments, officials are careful not to put such requirements in writing, usually resorting to oral communications to pressure foreign firms to transfer technology.[46] In 2012, 23 percent of the value of all foreign direct investment projects were joint ventures.[47] And the U.S.-China Business Council's "2014 China Business Environment Survey" reports that 62 percent of companies had concerns about transferring technology to China, while 20 percent reported that they had been requested to transfer technology to China within the past three years.[48]

Forced technology transfer is not new. A 1987 Congressional Office of Technology Assessment report states, "Although most U.S. firms approach the China market with the intent to sell products, many find they must include technology transfer if they wish to gain access to the China market."[49] But what is new are two things. First, there are more foreign companies seeking to get in the Chinese market, such that the scale of forced technology transfer is much larger than it was two decades ago. In 2015 for example, 6,000 new international joint ventures, amounting to $27.8 billion of FDI inflows, were established in China.[50]

Second, the sophistication and value of the technology the Chinese government is now demanding is significantly higher than in decades past when U.S. companies could afford to give their Chinese "partners" older generations of technology, confident that the U.S. firms could innovate faster. Now for many foreign advanced industry companies, doing business in China

requires transferring ever-more valuable technology to Chinese joint venture partners. In 2013, 35 percent of U.S. business respondents in China said that tech transfer requirements were a concern, and 42 percent in advanced technology industries voiced this concern.[51] Fifty-six percent of survey respondents who gave a response thought that tech transfer requirements were increasing.[52] And as USTR points out in its 301 report on China, it is likely that these numbers are under-reported.[53]

The Chinese government has employed the weapon of forced technology transfer to gain technological know-how in a variety of industries. A well-known case in point concerns high-speed rail. Over the past 15 years China built the largest high-speed rail network in the world. That massive purchase of rolling stock, signal systems, and related equipment was something no foreign rail producer could afford to ignore. As such, the Chinese government had enormous leverage to pressure foreign producers to give the Chinese state-owned enterprise competitors key technology and IP. The Chinese term for this is "exchanging market for technology."[54] As Chen and Haynes document, in 2004 the State Council of China adopted a new railway development strategy that shifted from just subsidizing domestic producers in order to help them improve their technology to one where they "introduce advanced technology through joint design and manufacturing, [with an ultimate objective to] to build a Chinese brand."[55] After that the state Ministry of Railways (MOR) launched three tenders for foreign high-speed electric trains and in each one MOR stipulated that foreign companies had to collaborate with domestic partners in the competition and had to transfer key technologies to achieve localization.[56] The tender included two key conditions: to win, the bidder had to transfer technology to China and the final products had to marketed under the Chinese state-owned enterprise rail car brand. This was all in support of the government's "Action Plan for the Independent Innovation of Chinese High-Speed Trains." As a result, multiple foreign train companies were pressured to transfer valuable technology to the Chinese companies (now principally one company due to the central government forcing the two main companies to merge into a powerful national champion, Chinese Railway Construction Corporation, now the largest rail producer in the world.) As Chen and Haynes write, "The result is a new HSR [high speed rail] industry in China has emerged which now serves the new vast HSR network and looks externally to export its new skill in HSR production and its new cutting-edge activity in HSR innovations." Not only are CRCC and related Chinese companies virtually guaranteed all Chinese rail projects, but CRCC is now aggressively exporting trains and train systems containing advanced foreign technology to other nations, backed with generous export subsidies from the central government. For example, the China Export-Import Bank (a state agency) announced in 2017 the equivalent of $30 billion in financing assistance for CRCC exports.[56] (Surprisingly, the U.S. Department of Commerce International Trade Administration, in its document promoting U.S. rail export opportunities to China, makes no mention of the fact that the lion's share of these opportunities come with forced technology transfer requirements.[57])

The Chinese have employed different tactics to the same end in the biopharmaceutical industry, where various policies enable Chinese firms to get access to U.S. technology. For example, the relatively short six-year term for data exclusivity, coupled with the lack of a formal definition of a "new chemical entity," means the Chinese government can pressure U.S. firms to turn over important data to Chinese generic drug firms. Similarly, the Chinese government requires that

any drugs sold in China must go through Chinese clinical trials, even if they are approved in the United States. This extends the time for sales before a company can sell a drug by as much as 8 years, meaning that the company has only 12 years left of patent-protected sales in China before a Chinese generic company can copy the drug. Moreover, in China, unlike the United States and Europe, there is no extension of marketing exclusivity at the back end to take into account long clinical trial delays. Moreover, China also issues compulsory licenses for the intellectual property for particular drugs.[58] Finally, it presses foreign biopharmaceutical companies to form joint ventures if they want their drugs more easily put on the government list of drugs to qualify for reimbursement.[59]

We also see this in cloud computing. China requires companies running cloud-computing operations to be locally controlled. This means that if a company like Amazon Web Services or Microsoft wants to serve the rapidly growing Chinese market it must partner with a Chinese company and sell their services under the Chinese company brand. And as part of this partnership the expectation is that the foreign cloud provider will provide the Chinese firm with technology and know-how.[60] Chinese cloud providers, like Aliyun, the cloud services unit of Alibaba, is able to establish its own data centers in the United States without any similar requirements.

Subsidies: Once Chinese firms gain access to needed foreign technology, the next step of the Chinese strategy is to ensure that they have the capital needed to scale up. This involves direct and indirect subsidies and also designing markets protected from foreign competition so the Chinese firms can accumulate capital. Once firms have the technology, competencies and scale to go global, the government often subsidizes global market expansion, such as through the China Export-Import Bank (an entity the World Bank has funded) and China's Export and Credit Insurance Corporation (Sinosure).[61] Moreover, by leading to global overcapacity and selling below cost, China uses that overcapacity as a cudgel to disrupt the economics of innovation-based industries (i.e., subsidized competition prevents foreign competitors from earning reasonable profits from one generation of innovation to reinvest in future generations of innovation) and thus weaken foreign competitors, enabling Chinese firms to gain even more global market share.

The Chinese government also works to limit foreign competition for its budding national champions. For example, in the high-end equipment manufacturing sector, China maintains a program that conditions the receipt of a subsidy on an enterprise's use of at least 60 percent Chinese-made components when producing intelligent manufacturing equipment.[62] And despite the fact that China "clarified and underscored ... that it agreed that enterprises are free to base technology transfer decisions on business and market considerations" at a December 2014 meeting of the United States-China Joint Commission on Commerce and Trade (JCCT), USTR notes that China has "announced two measures relating to [local procurement of] information technology equipment used in the banking services sector and in providing Internet- or telecommunications-based services more generally."[63]

China also lavishes Chinese firms that have obtained foreign technology with massive subsidies. As George and Usha Haley document in their book, *Subsidies to Chinese Industry: State Capitalism, Business Strategy, and Trade Policy*, China's game plan has long been to "aggressively

subsidize targeted industries to dominate global markets." As they document, in the 2000s, China provided almost $100 billion in subsidies to just three industries alone: $33 billion for paper, $28 billion for auto parts, and $27 billion for steel.[64] China's share of global solar panel exports grew from just 5 percent in the mid-2000s to 67 percent today, with Chinese solar output turbocharged by at least $42 billion of subsidies from 2010 to 2012 alone.[65] China now wants to replicate this strategy in other advanced-technology industries, such as semiconductors and electric batteries.[66] For instance, China's National Integrated Circuit (IC) Strategy calls for at least $160 billion in subsidies to create a completely closed-loop semiconductor industry in China, including explicit plans to halve Chinese imports of U.S.-manufactured semiconductors by 2025 and eliminate them entirely by 2035. The "Made in China 2025 Strategy" is supported by some 800 state-guided funds to the tune of more than $350 billion, including advanced-battery manufacturing, wide-body aircraft, and robotics.

Moreover, Chinese government-backed investment funds aim to control $1.7 trillion, equal to one-third of the assets in the global private equity market.[67] Since the global financial crisis, the Chinese government has moved aggressively to stimulate capital investment that will strengthen its competitive position, both domestically and in global markets. First created in 2008, there are now more than 2,000 of these so-called "government guidance funds," three-quarters of which have been established between 2015 and 2018. Having raised $530 billion so far, the funds already represent a massive vehicle for Chinese governments to subsidize Chinese tech companies and acquire foreign tech companies under the guise of venture capital. And the goal is for them to more than triple in size: The funds have been tasked with leveraging $1.7 trillion, which is 33 percent of the $5.2 trillion that private equity firms now control globally.

What is at Stake?

Given China's Made in China 2025 plan, it is no exaggeration to suggest that, without aggressive action, the United States may face a world within two decades where U.S. jobs in industries as diverse as semiconductors, computers, biopharmaceuticals, aerospace, Internet, digital media, and automobiles are significantly reduced due to Chinese policies unabashedly targeting domestic and global market share in those industries.

It is important to understand that the challenge to America's leadership in technology-based industries is much different than the process of losing more commodity-based, low-skilled industries to China in the 2000s. If, for example, the value of the dollar was to fall significantly related to the yuan (and other currencies), it is possible that America could regain at least some of the production lost to China in industries like textiles and apparel, furniture, metal parts, and other similar low- and medium-value added products. Companies could simply buy machines, set up factories, and restart production domestically in a cost-effective way. But if America's technology companies were severely weakened or even put out business, no currency decline could bring them back because competitiveness in technology industries is based less on cost and more on a complex array of competencies at the firm- and ecosystem-level. For example, a firm cannot simply buy some semiconductor equipment and start producing chips. To do that would

require not just machines but deep and complex tacit knowledge embedded in the firm in workers (from the shop floor to scientists to managers) coupled with an innovation ecosystem (universities training the right talent, a network of suppliers, etc.). Once those capabilities are lost, they are essentially gone, and are very difficult to resurrect absent massive government intervention.

There is an additional reason why losing advanced technology industries is problematic. Most technology-based industries have high barriers to entry. In contrast to the t-shirt industry where entry largely requires just capital to buy sewing machines, entry into innovation-based industries requires both physical and intellectual capital. In an industry like semiconductors, for example, firms spend hundreds of millions, if not billions, of dollars developing technical capabilities to enable production. Producing the first chip of a particular generation is incredibly expensive because of the amount of R&D involved. Producing the second chip is much cheaper because only the material and labor costs are involved. In this sense, fixed costs are extremely high, but marginal costs are low. In these innovation-based industries losing market share to unfairly competing firms supported by their innovation mercantilist governments means two things. First, sales fall. This is true because global sales are largely fixed (there is only so much demand for semiconductors, jet airplanes, and other similar advanced products), and if a mercantilist-supported competitor gains market share, the market-based competitor loses share. Second, because profits decline more than sales, it is now more difficult for the market-based innovator to reinvest revenues in the next generation of products or services, meaning that the mercantilist-supported entrant has an advantage in the next generation of products. This can lead to a death spiral whereby the market-based leader can lose complete market share.

A loss of advanced technology industries has two major negative impacts on the U.S. economy. The first is on prosperity, as the average wage in these industries is approximately 75 percent higher than average U.S. wages.[68] The second is on national security and the defense industrial base. U.S. defense superiority is based is in large part on technological superiority. Our service men and women go into any conflict with the advantage of fielding technologically superior weapons systems. But maintaining that advantage depends on the U.S. economy maintaining global technological superiority, not just in defense-specific technologies but in a wide array of dual-use technologies. To the extent the United States continues to lose technological capabilities to China, U.S. technological advantage in defense over China will diminish, if not evaporate, as U.S. capabilities whither and Chinese ones strengthen. It is certainly a highly risky proposition to assume that the United States can continue its weapons systems superiority over the Chinese if: 1) the Chinese continue to advance, largely through unfair, predatory practices at the pace they are; and 2) the United States loses a moderate to significant share of its advanced technology innovation and production capabilities. As ITIF wrote in 2014, "The United States defense system is still the most innovative in the world, but that leadership is not assured and is in danger of failing. This decline is not only impacting defense innovation and capabilities, but also overall commercial innovation and U.S. competitiveness."[69]

What the U.S. Government Should Do

To respond to the challenge from MIC25, the federal government needs to do two main things: 1) more aggressively work to constrain and roll back the unfair parts of MIC25 and other Chinese government policies; and 2) institute stronger domestic policies to help firms in advanced industries increase output (and jobs) in the United States.

Roll Back Chinese Innovation Mercantilism

There are an array of policies that can be instituted that can limit the harm from Chinese policies on the U.S. economy and also exert pressure on the Chinese government to roll back its unfair policies. While I list several here, the most important is for the Washington policy community to work to identify and implement what an array of possible policy actions in an array of areas (e.g. financial regulation, trade law, intellectual property law, criminal enforcement, customs enforcement, etc.).

One step Congress can take is to instruct USTR to bring a WTO case against China over its ongoing failure to publish thousands of trade-related final measures, including subsidies, in a single official journal as it's required to do under WTO rules. One reason it's been difficult to bring subsidy cases against China at the WTO is that China fails to properly publish its subsidies. Getting the WTO to enforce China's publication requirements would make it possible to bring additional WTO cases for subsidy or other violations, such as forced IP or technology transfer.

The United States also needs a new regime to contest China's strict technology-licensing laws. Under Chinese contract law and technology import-export regulations (or TIER), a foreign licensor into China is obligated to offer an indemnity against third-party infringement to the Chinese licensee.[70] In other words, a foreign licensor licensing into China has to provide insurance that practicing the licensed technology does not infringe any IP held by a third party. But, under TIER, this legal obligation only attaches to "technology import contracts." That is, this obligation only attaches to a foreigner licensing technologies into China; the Chinese licensor has no such obligation. This discriminates against foreign licensors. The foreign licensor is legally bound to offer something that the Chinese licensee is not, making it difficult for small companies, companies which may experience high litigation risks in China's litigious environment, and companies engaged in collaborative research and development (such as cross-licensing, open-source licensing, and charitable activities) to arrive at mutually beneficial licensing agreements. TIER makes it almost impossible for small companies, such as start-ups, to license their breakthrough technologies in China, because no start-ups (due to their limited resources) would be able to conduct the complex analysis required by China's high-litigation environment and industrial policies that limit the value of foreign IP in order to offer insurance against third-party infringement disputes. While large multinational companies could avoid this issue by licensing technology (e.g., through their China-based subsidiaries), start-up companies cannot do so because they typically do not have subsidiaries in China. Consequently, the impact of the mandatory indemnification requirement on small- and medium-sized companies, and especially start-ups, is particularly acute.

Another provision in TIER mandates that in technology-import contracts, improvements belong to the party making the improvements, which typically is the Chinese licensee. Thus, foreign

licensors, including U.S. firms, cannot negotiate to own any improvements or to share the improvements with Chinese licensees, even if both licensing parties desire for the improvements to be shared or owned by the foreign licensors. Moreover, TIER prohibits any technology-import contracts to "unreasonably restrict the export channels" of the Chinese licensee, thereby impeding the ability of the two licensing parties to allocate markets as they see mutually beneficial. Put simply, U.S. companies are obligated under TIER to let Chinese firms own the improvements and cannot freely negotiate with Chinese entities.

To address this discrimination, Congress should enact a regime whereby if Chinese entities seek licenses in the United States, then the Chinese enterprise must license on the same terms by which foreigners are required to license into China. Such legislation would specifically require the Chinese licensor to offer an indemnity against infringement by the U.S. licensee and to stipulate that the U.S. licensees are entitled to own the improvements they make and receive a reasonable market allocation under the licenses. Another possible approach would be for Congress to pass legislation requiring that the U.S. company whose original technology was improved by the Chinese entity receives an automatic exclusive license to use that improved technology [in the United States], such that the full potential of the original technology owned by the U.S. companies is not encumbered by improvements owned by the Chinese entity. Although technology-licensing law is usually a matter of state contract law, the legislation would be enacted pursuant to Congress's power to legislate international commerce.

Congress should strengthen FBI-university partnerships to limit inappropriate IP transfer. The FBI should engage in a stronger partnership with U.S. research universities to help them better understand how to take steps to better identify students here for the purpose of intellectual property transfer and how to limit such access. The point is not to just limit access and transfer of sensitive military technology subject to deemed export controls, but also advanced technology that can help China compete with the United States. At the same time, Congress should support FBI efforts to beef up and better target commercial counterintelligence resources to better help enterprises in the United States stop Chinese commercial espionage.[71]

Congress should work to establish stronger authorities to prohibit Chinese firms that are stealing IP from accessing the U.S. banking and financial system. For example, it should empower the Treasury Department to deny Chinese-headquartered enterprises access to listing on U.S. stock exchanges if they fail to provide financial statements in line with generally accepted accounting principles.

Congress should pass legislation that allows firms to ask the Department of Justice for an exemption to coordinate actions regarding technology transfer and investment to other nations. One of the key levers China has is that it's a monopsonist: its market is so large it can essentially compel foreign companies to hand over technology in order to sell their products in China. But if companies in a similar industry can agree that none of them will transfer technology to China in order to gain market access, then the Chinese government will have less leverage over them. The same would be true if companies agreed that they would not invest in China until China

improved its IP protections. Such an amendment to antitrust law would be similar to the 1984 Cooperative R&D Act, which allowed firms to apply to form pre-competitive R&D consortia.

Congress should also stand up a new arm of DOJ's antitrust division focused on foreign government-enabled and led antitrust violations. Currently, DOJ can bring actions against foreign firms if they are found to be acting in an anticompetitive manner. DOJ needs to not only be able to but be willing to bring actions against foreign firms if their actions are helped by their state in a way that leads to anticompetitive results. In the case of China, its subsidies, forced technology transfer, IP theft, and other unfair actions give Chinese firms unfair advantages that distort markets in an anticompetitive manner. DOJ should be able to investigate cases and if they found a violation, bring those to an administrative law judge who would adjudicate the case and the damages the U.S. government could impose on the Chinese companies that benefited from the anti-competitive Chinese government policies or practices. The challenge will be that not all Chinese companies likely to have cases brought against them are involved in the U.S. market. But some are, and for the ones that aren't such a ruling would effectively preclude them from entering the U.S. market.

Take Stronger Actions to Support U.S. Advanced Industry Competitiveness

While policies and actions to roll back Chinese mercantilist actions are critical, the United States also needs to do much more to boost U.S. competitiveness at home. Congress should take efforts to limit Chinese efforts to manipulate its currency for competitive advantage, as it has done over the last year to suppress the price effects from the Trump administration tariffs on Chinese imports. Congress also need send clear signals to the Treasury Department that the official policy of the U.S. government should not be to maintain a strong dollar (meaning any value of the dollar stronger than what is needed to run balanced trade). A strong dollar hurts American workers, especially in traded sectors, by increasing the pressure on companies in the United States to keep wages low as a way to stay competitive. Rather the policy should be to work to lower the value of the dollar until U.S. trade is in balance, and then after that to let market forces determine currency levels.

But a more fairly valued dollar is not enough. Congress needs to consider policies to help U.S. companies boost productivity. As such, America needs its own "Invented and Made in America 2029" program where the federal government identifies the technologies most important to America's national and economic security and allocates at least an additional $25 billion annually to support their development.[72] As part of this a key area is to work to improve U.S. manufacturing productivity growth, which in the last decade has been anemic, averaging about one-third of the growth rates of the prior two decades. Lagging productivity growth makes it harder to companies, especially in traded sectors to boost employee compensation. There are host of steps Congress can take to help firms, especially manufacturers boost productivity, including significantly boosting funding of NIST's Manufacturing Extension Partnership program, expanding the number of and funding duration of the Manufacturing USA Institutes, boosting funding for NSF's National Robotics Initiative, and establishing a program to fund community colleges to establish robotic test bed and training facilities that small manufacturers and workers could access.

There are other actions to consider, many of which ITIF has detailed in its report "The Competitive Edge: A Policymaker's Guide to Developing a National Strategy."[73] These include expanding lending authorities for the Export-Import Bank,[74] increased efforts to develop STEM talent, and spurring more technology transfer from universities and federal labs.[75] Moreover, the federal government should work to establish a deeper North American supply chain, which would provide U.S. companies with an alternative to the Chinese supply chain. Approving the USMCA trade agreement would facilitate that.

Finally, the recent tax reform bill allowed first year expensing of machinery and equipment helped spur more investment including presumably in robots, but it is due to expire at the end of 2022. And in 2022 companies will have to deduct R&D expenditures over five years. Congress should make expensing for capital investment and R&D expenditures permanent, while at the same time increase the Alternative Simplified Credit rate from 14 percent to at least 25 percent.[76] (At least 26 nations now field a more generous R&D tax incentive).

The Challenge to Small Business and Policy Responses

More robust small business growth and new firm formation, especially in trade sectors, will be critical to restoring robust and vibrant economic growth. For the purpose of thinking about competition from MIC25 there are three kinds of small businesses: 1) suppliers to globally traded original equipment makers (OEMs); 2) companies that themselves sell directly in global markets; and 3) domestic serving, consumer-facing companies (e.g. dry cleaners, barbers, grocery stores, etc.). Unfair competition from China hurts all three kinds, but the biggest impact is on the first two. As large companies close or contract domestic facilities, either because of Chinese competition or because they have moved production to China, most of the supplier contracts move to China. At the same time, why start a small manufacturing company if you know you will face robust and subsidized competitors from China or face a risk of having your IP stolen? Overall, there is less incentive to start a new manufacturing firm when many big U.S. customers are now overseas, or when you know you will face a big, subsidized foreign competitor, which is why efforts to roll back Chinese innovation mercantilism need to be a key part of any small business agenda.

But there are also are a host of steps Congress could take to help new and small business, particularly in globally traded sectors. One step would to be encourage the Small Business Administration (SBA) to focus more resources on firms in traded sectors, like agriculture, manufacturing, and software, content and internet services. Currently the SBA treats all industries alike in its funding priorities, but industries serving local markets (e.g., liquor stores) play little role in supporting local or national economic competitiveness, and by and large providing funding to them simply shifts activity from one firm to another. Neither of these things is true for firms in industries that are globally traded, yet only 7.5 percent of loans under the SBA's primary program for assisting small businesses (7A loan program) go to manufacturers. Congress should require the SBA to develop a plan to significantly increase the share of support going to traded-sector firms.[77]

Congress should also establish a 401(k)-like deferred-investment program that would give small and mid-sized manufacturers greater resources to bootstrap themselves by allowing them to make tax-deferred investments through manufacturing reinvestment accounts. The funds would be available for tax-free withdrawal if used for R&D, workforce training, or capital equipment investments. Connecticut has already put such a program in place.[78]

Congress should also consider removing obstacles to the tax code to limit the growth of technology startups. Current law prevents passive investors from taking advantage of net operating losses or research tax credits of the companies in which they invest. This makes sense for tax shelters that are never meant to be profitable. But it makes it even harder for small research companies to find investors. Congress should create an exception for companies that devote over half of their expenses to research and development and that have fewer than 250 employees and less than $150 million in assets. Investors could only use that portion of the losses or credit that was devoted to qualifying research activity.[79] In addition, firms can normally carry past operating losses forward in order to deduct them from future income, thereby lowering their taxes. Under Section 382 of the tax code, firms lose this ability when they undergo a change in ownership. Since small research-intensive startup firms often engage in successive financing rounds before achieving success, this provision makes it hard for them to ever recover their past losses and artificially inflates their historical income for tax purposes. Congress should exempt that portion of net operating losses that are generated by small firms that conduct qualifying research and development activities.[80]

Congress should introduce an Open Commercialization Infrastructure Act. One way to increase the use of America's national R&D infrastructure would be to pass an "Open Commercialization Infrastructure Act" that permits private use of bonded facilities—including universities, federal labs, and public libraries—for certain activities related to entrepreneurial education and training as well as for economic development and job creation. This would be useful because buildings that are financed through tax-exempt bonds currently are not permitted to develop private programming. For example, a small business trying to develop a commercial product would be restricted from taking advantage of a 3-D printer in a makerspace at a bonded facility such as a public library. This and many other kinds of private activities that benefit entrepreneurs—such as business incubators, accelerators, and training programs—are important for broader economic development. Congress should ensure more infrastructure is available for such purposes.[81]

The current federal system for funding research also pays too little attention to commercializing technology and is still based on the linear model that assumes basic research gets easily translated into commercial activity. To address this, the administration should work with Congress to establish an automatic set-aside program that allocates a modest percentage of federal research budgets to technology-commercialization activities. For instance, Congress could allocate 0.15 percent of agency research budgets to fund university, federal laboratory, and state government technology-commercialization and innovation efforts. The funds could be used to provide: 1) "commercialization capacity-building grants" to institutions of higher education pursuing specific initiatives to improve their capacity to commercialize faculty research, and 2) "commercialization-

accelerator grants" to support institutions of higher education pursuing initiatives that allow faculty to directly commercialize research in an effort to accelerate research breakthroughs.[82]

Congress should allow a greater share of SBIR and STTR grant awards to be used for commercialization activities. SBIR's impact could be much greater if some facets of the program were geared significantly more toward commercialization. Awardees currently are prohibited from using grant money to fund critical commercialization activities that would enable them to raise their profiles and accomplish certain key milestones so they can build prototypes of new products or services, acquire commercial customers, attract private capital, or accelerate market entry. These activities cover the gamut from intellectual-property development and prosecution to marketing and staff recruitment. To fill these gaps, SBIR awardees should be permitted to expend at least 5 percent of their SBIR funds on commercialization-oriented activities. For instance, in the lasts Congress, the Support Startup Business Act (S. 2149), co-sponsored by Sens. Chis Coons (D-DE) and Cory Gardner (R-CO), would allow program awardees to allocate up to $50,000 of their awards for commercialization-related activities, including services such as market validation, IP protection, market research, and business model development.[83]

Finally, Congress should create an "Innovation Voucher" program operated by NIST. As in almost a dozen other countries, these vouchers can spur innovation and stimulate knowledge transfer by allowing small and mid-sized enterprises to "buy" expertise from universities, national labs, and research institutions to conduct studies, analyze the innovation potential of new technologies, etc. A promising example has been the Small Business Voucher Pilot program in the Energy Department's Office of Energy Efficiency and Renewable Energy (EERE), which has provided vouchers to 114 small business across 31 states, disbursing more than $22 million since 2015. For example, the Oak Ridge National Laboratory (ORNL) collaborated to launch "RevV," a $2.5 million manufacturing innovation program that offers vouchers for manufacturers in Tennessee to access the world-class researchers and facilities at ORNL. The administration should work with Congress to extend such vouchers across the entire federal lab system under the auspices of NIST by authorizing $50 million that would be state-matched.[84]

CONCLUSION

In summary, taking firm and strategic action against Chinese predatory, mercantilist practices, while at the same time establishing and implementing a robust national innovation and competitiveness strategy are critically needed if we are to assure future U.S. advanced industry competitiveness. Whether or not such actions can be successful is an open question. But one thing is clear: not taking action will make it much easier for the Chinese government to achieve their goal of dominating advanced technology industries.

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Chairman RUBIO. Thank you.
Mr. Rush.

STATEMENT OF ANDREW RUSH, PRESIDENT AND CEO, MADE IN SPACE, INC.

Mr. RUSH. Chairman Rubio, Ranking Member Cardin, and members of the Committee, thank you for the opportunity to speak with you today.

Innovation and technical advancements are really the most critical components of our national infrastructure. As the global landscape shifts, it is imperative that our Nation maintains its superiority in both the commercial markets and in defense.

I believe that America's leadership in space will be the key to fortifying our American industry and military strength.

As the CEO of Made in Space, I am really honored to lead a company that is really pioneering a new space economy and supporting our Nation's exploration and defense objectives. Made in Space is the industry leader in space manufacturing technology and products for both commercial and government customers.

We are developing new capabilities to produce in-space manufacturable satellites, which leverage additive manufacturing and robotic assembly. This new technology will really redefine the future of our space infrastructure, enabling next-generation spacecraft and platforms to be built, reconfigured, and repaired on orbit.

Key enablers of this incredible progress have been strong support from NASA, DARPA, other government agencies, and public-private partnerships.

Specifically, this support has seen us transform our base technology and capabilities from programs—into programs focused on meeting ambitious exploration and defense objectives.

Our In-Space Manufacturing program was initially demonstrated through a grant from NASA's Flight Opportunities program, which allowed us to test a gravity-independent 3D printer on a parabolic flight.

After this first successful demonstration, we were rewarded a series of NASA SBIR contracts to develop and operate the first 3D printers on the International Space Station.

In 2014, we manufactured the very first functional objects that humanity ever made off the face of the planet. This flight tipping technology, which is supported by NASA, is now meeting the demands of both commercial and government customers on orbit.

Further building on the success, Made in Space was selected to participate in the NASA STMD In-Space Robotic Manufacturing and Assembly program, or IRMA for short. The IRMA program is a two-phase program, which seeks to transform the way that we manufacture, assemble, and repair large structures and satellites in space, and IRMA is a really powerful example of how the government can spur technological innovation and advance American industry.

IRMA operates with a public-private partnership, requiring at least 25 percent of the development cost of the program to be contributed by industry, with really the primary focus on this being to develop tipping point technologies that will be used both by commercial and government users.

Phase I of this was focused on ground demonstration, and in Phase II, there is focus on definitive flight demonstrations in space to push these technologies past those tipping points, enabling the use of this technology for operational defense, commercial, and civil space missions.

This programmatic structure is enabling American industry to develop and implement technologies which improve satellite design and operation in the future and provide significant advantages over the U.S.'s competitors.

Despite these triumphs, space is becoming an increasingly contested environment. Mere years after Made in Space first demonstrated the ability to 3D print in microgravity, Chinese researchers aboard parabolic aircraft demonstrated that same technological feat.

And just as Made in Space and NASA have been progressing from parabolic flights to developing in-space manufacturing and assembly technologies for space missions, China is taking a similar approach.

The China Academy of Space Technology Corporation, a major Chinese aerospace contractor, has recently announced plans to develop and deploy large-scale space-based solar power stations. By 2025, using in-space manufacturing and assembly technologies, they plan to begin constructing power stations, which will beam power from space to the ground in China. The technologies used to construct such power stations can also be used for next-generation military and civil space assets and are potentially being developed at a pace that is faster than current U.S. investments in this kind of technology.

We at Made in Space have benefited enormously from the virtuous cycle of technology development and operation enabled by NASA and other government agencies. We are grateful to those that have helped us along the way and are proud to continue this work.

Over the next decade, the space economy will continue to grow due to this support, but competitors such as China have taken note of this. While the U.S. currently has an edge in high-impact areas, such as in-space manufacturing and assembly of satellites, this advantage is eroding.

Additional investment is required and operational mission infusion should be accelerated in order to maintain America's edge in these important areas, or else we risk losing the ultimate high ground of space.

Thank you.

[The prepared statement of Mr. Rush follows:]

Andrew Rush
President & CEO
Made In Space, Inc.

Testimony of

Andrew Rush

CEO

Made In Space, Inc.

Before the

U.S. Senate Subcommittee on Small Business & Entrepreneurship

Hearing on

"Made In China 2025 and the Future of American Industry"

February 27, 2019

Russell Senate Office Building, Room 428A

Washington, DC

MADE IN SPACE

Andrew Rush
President & CEO
Made In Space, Inc.

Introduction

Continuous technological innovation has been foundational to maintaining America's commercial and military superiority on the ground and in space. Made In Space, Inc. (Made In Space, MIS) is developing technologies and business models that will enable and drive people to one day sustainably live and work in space. In 2014, Made In Space hardware successfully produced the first functional objects manufactured off the face of the planet. Today, Made In Space has several in-space manufacturing programs underway and is commercially manufacturing for customers aboard the International Space Station. This success would not be possible without the Small Business Innovation Research Program, public-private partnerships like the In-Space Robotic Manufacturing and Assembly Tipping Point program (IRMA), and access to the International Space Station (ISS).

In the space domain in particular, new capabilities are needed in order to maintain and grow America's edge over others. Space is critical to both the American economy and to our defense apparatus. To this end, Made In Space is developing in-space manufacturable satellites. Using a combination of additive manufacturing and robotic assembly, this capability allows satellites to utilize mass and volume much more efficiently and eliminates design constraints that the harsh mechanical environment of launch places upon spacecraft. In-space manufacturing also enables satellites to be repairable and reconfigurable, making both civil and military spacecraft more resilient to changing threats in space.

Technological innovation is the engine which will keep us ahead of China and other nations. Space is acknowledged as integral to the current national economy, an area of high economic growth over the next decade, and, increasingly, as formally recognized by the Department of Defense in 2017, a warfighting domain. Because of these factors, it is imperative that active measures be increased to develop new technologies and business models which utilize space for commerce, science, and defense.

In order to maintain and grow America's space-based edge over China and others, Made In Space strongly encourages continued support of programs which enable the step-by-step development of new commercial space capabilities, including the SBIR program, NASA's IRMA program, DARPA's support of in-space manufacturing and assembly development, and the International Space Station.

MADE IN SPACE

Andrew Rush
President & CEO
Made In Space, Inc.

Made In Space, Inc. and the Emerging Cislunar Economy

Made In Space is a small business with offices in California, Florida, Alabama, and Ohio.

Made In Space was founded in 2010 with the goal of enabling people to sustainably live and work in space.

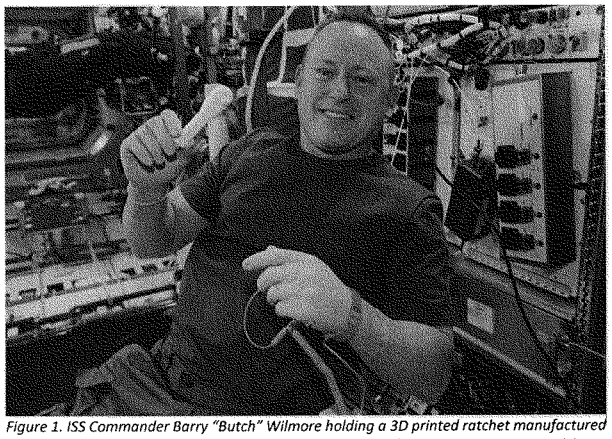

Figure 1. ISS Commander Barry "Butch" Wilmore holding a 3D printed ratchet manufactured in space. The ratchet was designed on the ground and manufactured in space one week later, making it potentially the fastest delivery to space ever. Image credit: NASA

This goal is shared by many in the space industry who believe in the economic promise the final frontier holds. Companies like SpaceX and Blue Origin are focused on building low cost launch vehicles, 21st century versions of the covered wagon. We at Made In Space are focused on developing the tools and manufacturing facilities that will fill those wagons to the stars, enabling growth portions of American industry in a regime where China and others are increasingly competitive with U.S. offerings.

We focus on two types of space-based manufacturing: manufacturing technologies that enable new missions in space; and manufacturing technologies which leverage the space environment to create high value goods for use on Earth. We believe these areas will drive significant growth of American industry over the next decade. Furthermore, they represent technical advantages the U.S. possesses over China and others which should be developed and implemented in operational civil and defense space applications as quickly as possible before they are duplicated or surpassed.

NASA and OGA Support Enables Manufacturing In Space For Use In Space and the Future of American Industry In Space

In-space manufacturing and assembly dramatically reduces spacecraft cost, reduces the limitations rocket launch places on spacecraft design, and removes astronauts from harm's way. Traditionally, satellite design has been constrained by launch-shroud size and launch load/environment survivability requirements. Similarly, due to lift capacity limits and the high risk and low availability of astronaut EVA for assembly, creating large space-based structures such as space stations has been a once-in-a-generation endeavor. Archinaut minimizes or removes these and other design limitations.

Andrew Rush
President & CEO
Made In Space, Inc.

In-space manufacturing and assembly enables a wide variety of desirable missions. These include largescale telescopes for astrophysics missions, increased power production for small satellites, and future space station backbones. In-space manufacturing and assembly is also transformational for defense applications, enabling largescale reflectors, long baseline structures for civil and defense SAR applications, and space-based solar power stations. Additionally, these technologies enable satellites to be modified, repaired, or reconfigured on orbit, thereby enabling these assets to be more resilient and durable in a manner that does not exist in the current "fire and forget" approach to satellite design, manufacture, and deployment.

Working closely with NASA, DARPA, and others and utilizing multiple pieces of the space infrastructure described above, Made In Space has made significant progress in developing and demonstrating in-space manufacturing technologies for both satellite applications and human spaceflight missions. MIS engineers initially internally developed a prototype gravity-independent 3D printer. Through a grant from the NASA Flight Opportunities Program, that prototype was tested and successfully operated on board a parabolic flight aircraft in 2011.

Based on this success, Made In Space was awarded SBIR contracts to develop the technology for demonstration aboard the ISS. Via an SBIR Phase III contract with NASA run out of the In-Space Manufacturing group at NASA Marshall Space Flight Center, Made In Space built and operated the first 3D printer to operate in space. In late 2014, via the 3D Printing In Zero-G Technology Demonstration experiment, this space-capable 3D printer was installed on the ISS and manufactured the first functional objects ever made off the planet Earth (see Figure 1).

Thereafter, Made In Space built the Additive Manufacturing Facility (AMF, see Figure 2), a second-generation more capable 3D printer. The AMF was launched to the ISS in March 2016. Via agreements with NASA and the Center for the Advancement of Science In

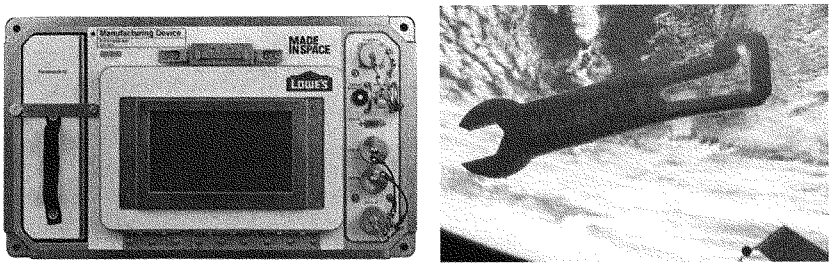

Figure 2. The Additive Manufacturing Facility (left) is the first ever commercial manufacturing facility deployed to space. The first commercially manufactured part in space was a space optimized hand tool (right). Image credits: NASA/Made In Space.

Space (CASIS), the managers of the ISS National Lab, Made In Space owns and operates the AMF, routinely sending print jobs to the ISS and manufacturing them on a

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weekly basis. The AMF print services business is profitable and has produced parts for NASA, the U.S. Navy, Lowe's, universities such as Texas A&M University, student groups, and even individuals. Parts manufactured include space optimized structures, hand tools for the ISS crew, prototype medical splints and ventilators, and adaptors for ISS equipment. This commercial service is one of several pioneering commercial uses of low Earth orbit. These uses represent pathfinders for future commercial space station-based businesses, a future cornerstone of American industry's utilization of space.

The capability to manufacture parts on demand during a space mission is paradigm shifting. 3D printing serves as a fast and inexpensive way to manufacture parts on-site and on-demand, reducing the need for costly spares on the ISS and other spacecraft. Long-term missions would benefit greatly from having onboard manufacturing capabilities. New parts may be manufactured to enable new scientific experiments or augment existing ones.

Further building on this success and internal research and development into manufacturing very large, space-optimized structures in space, Made In Space was selected to participate in the two phase NASA Space Technology Mission Directorate In-Space Robotic Manufacturing and Assembly Tipping Point program (IRMA) program. The IRMA program seeks "to transform the way we manufacture, assemble and repair large structures in space, leading us closer to a robust space infrastructure freed from launch window scheduling, launch vehicle mass limitations and astronaut safety concerns. Ultimately, [IRMA] will enable more frequent science and discovery missions in Earth orbit, across the solar system and beyond."[1] Furthermore, IRMA operates via "public-private partnerships to deliver technologies and capabilities needed for future NASA, other government agency, and commercial missions."[2] Tipping point technologies were sought. That is, technologies and capabilities which, if investment was made in a flight demonstration, there would be "significant advancement of the technology's maturation, a high likelihood for utilization of the technology in a commercially fielded space application, and a significant improvement in the offerors' ability to successfully bring the space technology to market" thereby enabling the capability to be available to NASA and OGA's but sustained by the commercial market, resulting in more cost effective and better technological outcomes for the government.[3]

Phase I of the IRMA program focused on ground demonstrations of in-space manufacturing and assembly technologies, maturing these technologies for flight demonstrations in Phase II where properly planned definitive demonstrations in space will push these technologies past the tipping point and raise their technology readiness level to the point that civil, defense, and commercial customers will utilize the technologies for

[1] See: https://www.nasa.gov/mission_pages/tdm/irma/index.html
[2] See NASA Solicitation UTILIZING PUBLIC - PRIVATE PARTNERSHIPS TO ADVANCE TIPPING POINT TECHNOLOGIES appendix number NNH15ZOA001N-15STMD-001 to NASA Research Announcement (NRA): Space Technology - Research, Development, Demonstration, and Infusion – 2015 (SpaceTech–REDDI–2015), NNH15ZOA001N released May 21, 2015.
[3] *Id.*

operational missions. This programmatic structure and focus is enabling American industry to develop and implement technologies which will improve satellite design, operation in the future, providing significant advantages over the U.S.'s competitors.

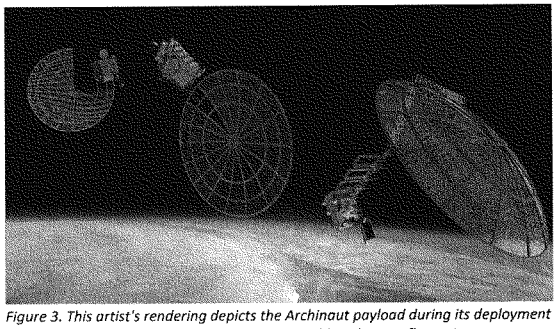

Figure 3. This artist's rendering depicts the Archinaut payload during its deployment in space. Via additive manufacturing and assembly, a large reflector is manufactured and integrated over time. Image credit: Made In Space

Under a Phase I contract begun in late 2016, Made In Space led a team including Northrop Grumman to develop its Archinaut in-space manufacturing and assembly technology (see Figure 3). During rocket launch, spacecraft are subjected to high g forces and large vibrational forces. Further, the entire spacecraft must fit within the limited volume of the launch fairing. Surviving this launch environment requires wasting mass to over engineer components to survive launch and engineering deployables which unfurl once the satellite reaches orbit, creating points of failure. Archinaut technology will enable optimization of spacecraft structures for their operational environment, rather than launch. Additionally, repair and reconfiguration of assets once they are on orbit will be possible. Further, this technology enables providing large structures at lower cost and enabling robotic manufacture and assembly of large reflectors, space stations, and other applications for civil, defense, and commercial space customers. Before operating in space, this technology was demonstrated in NASA environmental testing facilities and aboard ISS via AMF, including manufacturing space-optimized structures in space.

The Archinaut Development Program is a private-public partnership designed to develop a technological capability that is useful to both government and commercial customers. As part of its effort, the Made In Space-led team is contributing over 25% of the program cost. Made In Space believes that space technologies should be developed into products which are useful and sold to both government and commercial space customers. This expands their utilization and lowers costs for all customers.

The Future of American Industry Depends on Unrestricted Access to Space, China's Investments in the Space Sector Are Part of a Larger Space Strategy that Threatens This Access

The American space economy is expanding and innovating at a faster rate than any time since the Apollo program. Thanks to public-private partnerships such as the IRMA program and commercially oriented NASA programs like the Commercial Resupply Services program, the ISS Crew Transportation Services program, and their

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predecessors, commercial activity in space has never been stronger. Investments in certain aspects of the space economy, such as orbital launch and remote sensing, have also reached record highs.

However, it is critical to note that private sector investment is not driving expansion of the utilization of space across the board. Areas crucial to maintaining America's edge, such as defense, research and development, and technology demonstration, are often too niche or too early stage for significant private sector investment. An array of government-driven efforts help develop, test, and implement new technological innovations for civil and defense space applications. Many of these efforts also emphasize commercialization of technologies as they are developed, enabling the private sector to benefit from capabilities developed for civil or defense space needs.

Despite these triumphs, space is becoming an increasingly contested environment. Mere years after Made In Space initially demonstrated the ability to 3D print in microgravity, Chinese researchers conducted a very similar experiment aboard a parabolic aircraft, duplicating the technological feats of 3D printing in microgravity.[4] Much like Made In Space and NASA first demonstrated microgravity-capable 3D printing and then progressed to developing in-space manufacturing and assembly technologies and missions, it appears that China is following up on its initial demonstrations in a similar fashion. The China Academy of Space Technology Corporation, a major Chinese aerospace contractor, has recently announced plans to develop and deploy a large scale space-based solar power station. By 2025, using in-space manufacturing and assembly, they plan to construct a megawatt space solar power station which will be utilized to beam power to ground stations in China.[5] The technologies used to construct such power stations could also be used to create next generation military and civil space assets as described herein at a pace which is potentially faster than current space technology development investments permit.

Conclusion

Made In Space has benefited enormously from a virtuous cycle of technology development and operation enabled by the Small Business Administration, NASA, and OGA's. Made In Space is grateful to all those that have helped along the way and proud to continue working with NASA and other government agencies. Over the next decade, the space economy will grow due to this support. Competitors such as China have taken note of the progress on made in space technology development. While the U.S. currently has an edge in high impact areas such as in-space manufacturing and assembly of satellites, this capability advantage is eroding. Additional investment is required and operational mission infusion should be accelerated in order to maintain America's edge

[4] See http://english.cctv.com/2016/04/20/VIDE7CXvslir229CK0YHJkni160420.shtml detailing Chinese demonstration of 3D printing aboard parabolic flight test aircraft in April 2016. In the US, this was first successfully demonstrated by Made In Space via NASA's flight opportunities program in 2011.

[5] See https://3dprint.com/236795/chinese-scientists-building-solar-space-station-projecting-that-3d-printing-robotics-will-assist-future/

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in these important areas or else risk losing the ultimate high ground of space. This represents an existential threat to the U.S., both militarily and economically, in a wide array of known, and more worryingly, unknown arenas. If ceded this advantage may never be won back.

Chairman RUBIO. Ms. Glaser.

STATEMENT OF BONNIE S. GLASER, DIRECTOR, CHINA POWER PROJECT, CENTER FOR STRATEGIC AND INTERNATIONAL STUDIES

Ms. GLASER. Thank you, Chairman Rubio, Ranking Member Cardin, and members of the Committee for inviting me to testify today.

We are here talking about Made in China 2025. As you have said in your opening remarks, this is a 10-year industrial policy designed to transform China into an advanced global manufacturing leader.

But let us be clear. This is one of many industrial policies in China. This is not the only one. There is a thirteenth 5-year plan, very outstanding, which runs 2016 to 2020. China is moving away from market-led economic decision-making, to the extent that they ever were relying on the market.

Xi Jinping has spoken out very clearly about what China's goals are, and it is important to put the Made in China 2025 plan within the context of China's larger geostrategic goals.

Xi Jinping talked in the 19th Party Congress, October of 2017. He laid out a plan to achieve the great rejuvenation of the Chinese nation, 2049. That is the centennial of the founding of the Chinese Communist Party. And then he set out an interim goal of 2035 of making China into a top-ranked innovative nation. So there are many industrial policies that are aimed at achieving this goal.

So drilling down on Made in China 2025, what are some of the challenges and problems that it poses? First of all, this program will advance China's goal of military-civil fusion, another goal that Xi Jinping has set out, which aims at strengthening the country's innovation capability for dual-use technologies in key strategic industries. Obviously, this includes aviation, robotics, information technologies. It is going to help the People's Liberation Army become a more effective fighting force.

Secondly, China's ambition to control entire supply chains poses a risk that entire industries could come under Chinese control.

Thirdly, Chinese government subsidies distort markets, undercut U.S. and other foreign manufacturers, and results in overcapacity and the dumping of cheap products in the global market. We have seen this happen in the electric vehicle industry with batteries.

Fourth, made in China 2025 lays out a three-stage plan. So it starts with localizing and controlling segments of global supply chains, then to proceed with substitution, and finally to capture global market share. This is a three-step process that could enable China to displace foreign companies in some of these industries, both domestically and internationally.

Fifth, establishing quotas violates WTO rules against technology substitution, and you can find very specific quotas in all of these 10 areas.

Sixth, MIC 2025 puts a premium on the acquisition of advanced technology, and, Senator Cardin, you talked about some of the ways in which China is procuring technology illegally. There is also, of course, an emphasis on buyouts of foreign companies.

Finally, number seven, Made in China 20205 will help China to spread Chinese standards abroad and undermine Western standards. So among these target countries are going to be those that are linked to China's "One Belt, One Road," which seeks to tie Eurasian economies more closely to China through trade and investment.

I have laid out in my testimony some of the recommendations of what needs to be done. First on the list is certainly to protect intellectual property. We are doing a lot better, I think, and the Department of Justice having stood up the China Initiative, prosecuting and enforcement of cases going forward of suspected Chinese economic espionage is going to be very important. I think the Treasury Department should be sanctioning Chinese companies that benefit from cyber espionage. And counter-intelligence outreach should be expanded to U.S. startups and small businesses in sectors central to Chinese technology strategies that are vulnerable.

Secondly, we should be using the World Trade Organization. This is a dispute settlement mechanism that WTO provides a means to hold China accountable for its trade practices, including persistent theft of intellectual property, cyber-enabled espionage, and widespread use of subsidies. The U.S. has been successful in the past in winning WTO cases. We have won more than any other country, and it is a good means to try to protect the interests of American workers.

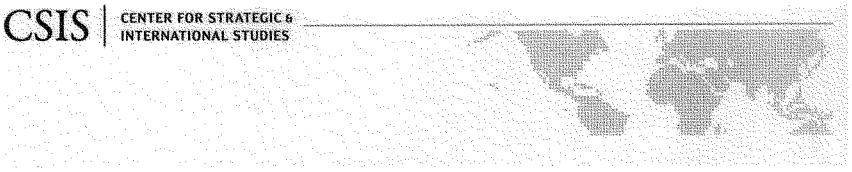
Where possible, we should be collaborating with international partners to bring trade cases against China at the WTO, and one such case could be targeting the forcing of our foreign firms to transfer technology and intellectual property.

Thirdly, I agree very much with this Committee's report and commend everybody on the hard work that you have put in it. The United States, I agree, cannot—and I quote the report—"escape or avoid decisions about industrial policy." As the U.S. strategizes about how to compete more effectively with China, we should consider the pros and cons of industrial policy making, rather than imposing tariffs that effectively tax U.S. companies they are supposed to defend. The U.S. should support innovation at home by providing more funding for basic research and development.

And, finally, I have suggested that we find, when the politics are right, a way to rejoin the TPP, now called the "CPTPP," because I think it provides one of the best options for the United States to compete more effectively with China and counter Made in China 2025.

Apologies for going over my time.

[The prepared statement of Ms. Glaser follows:]



Statement before the

Senate Small Business and Entrepreneurship Committee

"Made in China 2025 and the Future of American Industry"

A Testimony by:

Bonnie S. Glaser

Director, China Power Project

Center for Strategic and International Studies (CSIS)

February 27, 2019

428A Russell Senate Office Building

Thank you, Chairman Rubio, Ranking Member Cardin, and members of the committee for inviting me to testify today on the important topic "Made in China 2025 and the Future of American Industry."

The Made in China 2025 Plan (MIC 2025) is a ten-year, comprehensive industrial policy designed to transform China into an advanced global manufacturing leader. Like the concurrent 13th Five-Year Plan (2016-2020) and related state-led programs, MIC 2025 seeks to leverage the power of the Chinese state to promote indigenous innovation, advance technological self-sufficiency, and create comparative advantage in key strategic sectors on a global scale.[1]

The Chinese State Council document launching MIC 2025 issued in May 2015 clearly revealed Beijing's aim of comprehensively upgrading Chinese industry. The plan set the target of raising domestic content of core components and materials to 40 percent by 2020 and 70 percent by 2025. A substantial role for the state was highlighted, including through the utilization of financial and fiscal tools, support for the creation of manufacturing innovation centers (15 by 2020 and 40 by 2025), as well as assistance to Chinese firms to participate in international standards setting.

Although the goal of MIC 2025 is to upgrade industry writ large, the plan targets ten strategic industries in which China intends to foster the development of not only national champions but global champions. These ten priority sectors are: 1) advanced information technology; 2) automated machine tools and robotics; 3) aircraft and aeronautical equipment; 4) maritime vessels and marine engineering equipment; 5) advanced rail equipment; 6) new energy vehicles; 7) electrical generation and transmission equipment; 8) agricultural machinery and equipment; 9) new materials; and 10) pharmaceuticals and advanced medical devices.

China's Strategic Goals

MIC 2025 is part of Chinese President Xi Jinping's ambitious plan to achieve the "great rejuvenation of the Chinese nation" and restore China to what Xi believes is the country's rightful place as a great power by 2049 — the centennial of the PRC's founding. At the 19th Party Congress in October 2017, Xi laid out a multi-stage plan with specific goals for 2020, 2035, and 2050. By 2035, he said China would be a top ranked innovative nation and by the middle of the century would be transformed into a leading global power.

Xi called for mobilizing the Communist Party to lead the development of high-tech industries and make China a "country of innovators." He set out goals to strengthen basic research in applied sciences, accelerate implementation of major national science and technology projects,

[1] "Made in China 2025: Global Ambitions Built on Local Protections," U.S. Chamber of Commerce, 2017, https://www.uschamber.com/sites/default/files/final_made_in_china_2025_report_full.pdf.

and prioritize innovation in key technologies, while promoting cooperation among universities, government research institutes, state companies and small enterprises.[2]

In subsequent speeches, Xi Jinping has underscored the urgency to develop strategic emerging industries and make China into a leading high-end manufacturing superpower as well as a center for science and innovation. For example, in an address to top Chinese engineers and academics in May 2018, Xi called for the "fundamental transformation of business models of the manufacturing sector" and the "integration of the internet, big data and artificial intelligence with the real economy" so as to "move China's industries up to the middle and high-end in the global value chain."[3]

China's Ministry of Industry and Information Technology (MIIT) has laid out a three-step strategy for China to become a world leader in advanced manufacturing. The first step, which is to be achieved by 2025, requires China to "approach the level of manufacturing powers Germany and Japan during the period when they realized industrialization." The second step envisions China "entering the front ranks of second tier manufacturing powers" by 2035. In the third step, China will have become a member of the "first tier of global manufacturing powers" by 2045, and will have acquired "innovation-driving capabilities," "clear competitive advantages," and "world-leading technology systems and industrial systems."[4]

It is undeniable that Chinese leaders view economic policy as a means to achieve the goal of national rejuvenation, which is deemed essential to keep the Chinese Communist Party in power. Recognizing that the development strategy of reliance on low-cost labor to produce low-end manufactured exports for the world has run its course, MIC 2025 is part of Beijing's strategy to preserve its position as a manufacturing and export superpower, even in the face of rising wages and a declining workforce due to demographic challenges. To succeed, China must effectively compete with advanced industrialized economies.

What's the Problem with MIC 2025?

As the U.S. Chamber of Commerce noted in a report on MIC 2025 published in 2017, "As the Chinese economy matures . . . it is natural for China to pursue a more innovative economy

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[2] Xi Jinping, "Secure a Decisive Victory in Building a Moderately Prosperous Society in All Respects and Strive for the Great Success of Socialism with Chinese Characteristics for a New Era," delivered at the 19th National Congress of the Communist Party of China, October 18, 2017, http://www.xinhuanet.com/english/special/2017-11/03/c_136725942.htm.

[3] Speech by Xi Jinping to the opening of the 19th meeting of the Academicians of the Chinese Academy of Sciences and the 14th meeting of the Academicians of the Chinese Academy of Engineering, May 28, 2018. Hu Yongqi, "Xi calls for breakthrough in technology," *China Daily*, May 29, 2018, http://www.chinadaily.com.cn/a/201805/29/WS5b0c5ddca31001b82571cbfe.html.

[4] Made in China 2025 Explanation 6: The Manufacturing Power 'Three-Step' Strategy, Ministry of Industry and Information Technology, May 19, 2015, http://www.miit.gov.cn/n1146295/n1146562/n1146655/c3780688/content.html.

through significant investments in research and development as well as policies aimed at improving innovation capacity and economic efficiency."[5]

Moreover, the pursuit of an industrial plan by another country does not necessarily pose a threat to American industry. Germany's "Industry 4.0" plan, from which MIC 2025 drew inspiration, similarly aims to establish Germany as a lead market and provider of advanced manufacturing solutions.[6] The differences between MIC 2025 and Industry 4.0 are substantial, however. A few notable differences are that China's state subsidies are much larger and are used for many purposes, not just basic research as in Germany's plan. China also has specific targets for replacing imports with indigenous production, which is not a feature of Industry 4.0. In addition, Germany's economy is far more open to foreign participation and competition than China's economy.[7] Finally, in contrast to Germany's plan, the amount of support that the Chinese state will provide for MIC 2025 industries through state funding, low interest loans, tax breaks and other subsidies is not public. Some estimates put the likely number in the hundreds of billions of dollars.[8]

There are numerous reasons that MIC 2025 has rightly raised concerns in the United States and other countries with advanced economies. Below are a few of the most widely cited concerns:

1. MIC 2025 will advance China's goal of integrating its defense and commercial economies, which is aimed at strengthening the country's innovation capability for dual-use technologies in key strategic industries, including aviation, robotics, and information technology. Military-civil fusion was established as a national strategy by Xi Jinping in 2014 and is a pillar of China's military modernization drive that is aimed at making the People's Liberation Army a 21st century fighting force.[9] The Pentagon warned in 2017 that state-led Chinese investment in U.S. firms working on facial-recognition software, 3-D printing, virtual reality systems, and autonomous vehicles is a threat because such products have "blurred the lines" between civilian and military technologies.[10]

2. China's ambition to control entire supply chains, some of which have potential application to military manufacturing, poses a risk that entire industries could come under Chinese control. For example, only four companies today are comprehensive providers of

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[5] "Made in China 2025: Global Ambitions Built on Local Protections," US Chamber of Commerce, 2017, p.4, https://www.uschamber.com/sites/default/files/final_made_in_china_2025_report_full.pdf.
[6] Industry 4.0, https://www.gtai.de/GTAI/Navigation/EN/Invest/Industries/Industrie-4-0/Industrie-4-0/industrie-4-0-what-is-it.html.
[7] James McBride, "Is 'Made in china 2025" a Threat to Global Trade?" Backgrounder, Council on Foreign Relations, August 2, 2018, https://www.cfr.org/backgrounder/made-china-2025-threat-global-trade.
[8] See, for example, "China Manufacturing 2025," European Union Chamber of Commerce in China, 2017, http://docs.dpaq.de/12007-european_chamber_cm2025-en.pdf.
[9] Lorand Laskai, "Civil-Military Fusion and the PLA's Pursuit of Dominance in Emerging Technologies," *China Brief*, volume 18, issue 6, April 9, 2018, https://jamestown.org/program/civil-military-fusion-and-the-plas-pursuit-of-dominance-in-emerging-technologies/.
[10] Paul Mozur and Jane Perlez, "China Tech Investment Flying Under the Radar, Pentagon Warns," *New York Times*, April 7, 2017, https://www.nytimes.com/2017/04/07/business/china-defense-start-ups-pentagon-technology.html.

telecommunications equipment infrastructure: Huawei, ZTE, Ericsson, and Nokia. Two of those four are Chinese companies. Many other U.S. and European companies that were producing telecom equipment folded in the last few decades, including the American company Motorola. As the report *Made in China 2025 and the Future of American Industry* by this committee states: "If MIC2025 is successful . . . what the 'China shock' did to domestic U.S. production of electronics, furniture, plastics, metals, and vehicle parts could threaten to repeat itself in capital goods like machinery, automobiles, high-end computers, rail, and aerospace products."[11]

3. Chinese government subsidies distort markets, undercut U.S. and other foreign manufacturers, and result in overcapacity and the dumping of cheap products in the global market. Other Chinese state-led technology related plans have produced these negative outcomes. One example is the case of solar panels, where government support in the form of fiscal subsidies and tax incentives to the production of Chinese solar cells and panels combined with government-backed theft of intellectual property drove nearly 30 U.S. manufacturing firms out of the business.[12]

4. The plan suggests that China's intention is not just limited to joining the ranks of high-tech economies, but rather envisages displacing them. The plan foresees the targeted industries developing in three phases. First, localize and indigenize R&D and control segments of global supply chains. Second, after dependence on foreign technology has been reduced, proceed with substitution. Third, after Chinese technology and brands are developed, capture global market share. This three-step process could enable China to capture both domestic and international market share in many, if not all, MIC 2025 industries and technologies.

5. Establishing quotas violates WTO rules against technology substitution. In addition to the targets set by MIC 2025 for achieving 70 percent self-sufficiency in core components and critical materials by 2025 in a wide range of strategic industries, semi-official documents suggest that there are more specific local content quotas for Chinese enterprises, but these are not being highlighted publicly to avoid charges of violations of WTO rules.[13]

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[11] *Made in China 2025 and the Future of American Industry,* Project for Strong Labor Markets and National Development, U.S. Senate Committee on Small Business & Entrepreneurship, p. 20, https://www.rubio.senate.gov/public/_cache/files/d1c6db46-1a68-481a-b96e-356c8100f1b7/3EDECA923DB439A8E884C6229A4C6003.02.12.19-final-sbc-project-mic2025-report.pdf.

[12] Office of the United States Trade Representative, *Findings of the Investigation into China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation Under Section 301 of the Trade Act of 1974,* March 22, 2018, p. 14, https://ustr.gov/sites/default/files/Section%20301%20FINAL.PDF.

[13] Mercator Institute for China Studies, *Made in China 2025: The making of a high-tech superpower and consequences for industrial countries*, December 2016, p. 20. https://www.merics.org/sites/default/files/2018-07/MPOC_No.2_MadeinChina2025_web.pdf.

6. MIC 2025 puts a premium on the acquisition of advanced technology. Since China still lags behind in critical high-tech sectors, it is likely that there will be a strong push for foreign acquisitions through various means, including buy-outs of foreign companies as well as forced technology transfer agreements and use of cyber espionage to procure cutting-edge technologies.

7. Together with the Plan to Enhance Standardization and Quality of Equipment Manufacturing, MIC 2025 will help China to spread Chinese standards abroad and undermine Western standards. Among the targets will be countries linked to the "One Belt, One Road" project which seeks to tie Eurasian economies more closely to China through infrastructure, trade, and investment.

MIC 2025 Under Review?

After the United States imposed tariffs on China, which are in part aimed at punishing China's unfair practices and neutralizing the advantages enjoyed by Chinese companies, Beijing dropped references to MIC 2025 in official documents and authoritative media. Chinese officials have apparently said they are drafting a replacement for MIC 2025 that would play down the goal of making China the dominant global manufacturer and attempt to assuage U.S. concerns by opening up the Chinese plan to participation by foreign companies. Last December, media reports suggested that the new policy would be rolled out in early 2019, but so far, no new policy has been announced.[14]

Given the close linkages between MIC 2025 and Xi Jinping's staged plan for national rejuvenation, it is unlikely that substantial changes will be made, however. Rather, explicit parts of MIC 2025, such as the numerical targets for market share by Chinese companies, are likely to be removed from the public version of the program. Chinese advocates of upgrading the manufacturing sector through competition with world-class foreign companies are unlikely to prevail.

Recommendations

1. **Protect Intellectual Property:** China steals more intellectual property than any other country. According to the Department of Justice, China was involved in 90 percent of all economic espionage cases the Department handled from 2011 to 2018.[15] In addition,

[14] Lingling Wei and Bob Davis, "China Prepares Policy to Increase Access for foreign Companies," *The Wall Street Journal,* December 12, 2018, https://www.wsj.com/articles/china-is-preparing-to-increase-access-for-foreign-companies-11544622331.

[15] Statement by John c. Demers, Assistant Attorney General, National Security Division, U.S. Department of Justice, Before the Committee on the Judiciary, U.S. Senate, for a hearing on China's Non-Traditional Espionage Against the United States: The Threat and Potential Policy Responses," December 12, 2018, https://www.judiciary.senate.gov/imo/media/doc/12-12-18%20Demers%20Testimony.pdf.

more than two-thirds of the Department's theft of trade secrets cases have been linked to China. A report by the Foundation for Defense of Democracies found that Chinese cyberespionage costs U.S. companies an estimated $300 billion annually and poses the "single greatest threat to U.S. technology."[16] Increased focus on enforcement actions in cases of suspected Chinese economic espionage is essential. The U.S. government should also seek to sanction Chinese companies that benefit from cyber espionage. In addition, counter-intelligence outreach should be expanded to U.S. startups and small companies in artificial intelligence, semiconductors, telecommunications, quantum, and other sectors central to Chinese technology strategies.

Legislation recently introduced by U.S. Senator Kamala Harris (D-CA) to combat economic espionage would increase damages available for companies that are victims of trade theft, extend the statute of limitations for such crimes, and expand the scope of the Economic Espionage Act to cover cybercrime and hacking taking place outside the United States so that civil suits could be brought against perpetrators working abroad. Measures such as these will help American companies that are victims of Chinese espionage to fight back. By increasing the reputational costs to China and the real costs to Chinese companies, such actions may deter some Chinese hacking.

2. **Use the World Trade Organization:** U.S.-China trade negotiations are ongoing, but so far U.S. tariffs on more than $250 billion of imports from China in response to its trade policy abuses have not compelled the Chinese to alter their policies and practices related to technology transfer, intellectual property and innovation. In the meantime, U.S. tariffs have imposed high costs on American families and businesses. I am skeptical that tariffs will force China to fundamentally change aspects of its economic structure that are tied to Xi Jinping's plan to make the country into first-tier technological power by 2035.

   The United States should consider using the WTO's dispute settlement mechanism to hold China accountable for its trade practices, including its persistent theft of intellectual property, cyber-enabled economic espionage, and widespread use of subsidies. A recommendation made by the United States-China Economic and Security Review Commission is worth noting in this regard. In its 2018 report, the USCC proposed that the USTR investigate whether to bring a "non-violation nullification or impairment" case against China at the WTO under Article 23(b) of the General Agreement on Tariffs and Trade.[17] A non-violation claim allows WTO members to challenge measures that "nullify or impair" expected benefits, even if they do not explicitly violate WTO agreements. There are also WTO provisions that have not yet been explored that could provide the basis upon which to challenge China's trade policy practices. The United States has won

[16] Zack Cooper, "Understanding the Chinese Communist Party's Approach to Cyber-Enabled Economic Warfare," Foundation for Defense of Democracies," September 2018, https://s3.us-east-2.amazonaws.com/defenddemocracy/uploads/documents/REPORT_China_CEEW.pdf.

[17] 2018 Report to Congress of the U.S.-China Economic and Security Review Commission, November 2018, p. 76, https://www.uscc.gov/sites/default/files/annual_reports/2018%20Annual%20Report%20to%20Congress.pdf.

more WTO cases than any other country and such cases provide a means to protect the interests of American workers and intellectual property owners. Since joining the WTO, China has complied partly or fully in all but one of the 22 completed WTO cases that have been brought against it.

Working with allies and partners should be at the core of a U.S. strategy to effectively compete with a rising China. Where possible, the U.S. should collaborate with international partners to bring trade cases against China at the WTO. One potential WTO case could target China's continuing practice of forcing foreign firms to transfer technology and intellectual property. When China joined the WTO in 2001, it agreed that foreign companies could not be pressured by government entities to transfer critical technology to a Chinese partner as the price for approvals of joint venture licenses or other permits to do business in China. Despite Chinese government claims to the contrary, the disclosure of technology and IP as a condition of market access undeniably continues with Chinese government knowledge, if not encouragement.

3. **Consider Rejoining the Trans-Pacific Partnership (TPP):** The TPP (now the Comprehensive and Progressive Agreement for Trans-Pacific Partnership or CPTPP) provides one of the best options for the United States to counter China's MIC 2025 plan and to compete more effectively with China. Membership in CPTPP, which is a high-standard trade and investment regime, will provide U.S. and other foreign companies with incentives to diversify their supply chains away from China, thereby reducing their reliance on and vulnerability to China. Joining such a multilateral trade agreement with eleven other partners would also be an important step in restoring confidence in the United States and countering Beijing's narrative that the U.S. is an unreliable partner.

   Staying outside the CPTPP will prove harmful to American businesses. Beyond lowering trade barriers between the member countries, the deal includes greater protection of intellectual property rights and provisions to increase minimum labor standers for workers. The Peterson International Institute for Economics estimates that the U.S. income would have increased by $131 billion dollars annually, or 0.5 percent of GDP, if it had joined and is now set to lose about $2 billion dollars in income because U.S. exports will be less competitive in CPTPP nations.[18] Strengthening commercial ties with countries in Asia, Europe and the Americas can further pressure China to give up its unfair trade practices.

4. **Consider Adopting a U.S. Industrial Policy:** I agree with the findings of this Committee's report that the U.S. "cannot escape or avoid decisions about industrial policy."[19] As the U.S. strategizes about how to compete more effectively with China, we should consider the pros and cons of industrial policy making. The state has long been an

[18] Jeffrey J. Schott, "TPP Redux: why the United States is the Biggest Loser," January 23, 2018, https://piie.com/blogs/trade-investment-policy-watch/tpp-redux-why-united-states-biggest-loser.
[19] *Made in China 2025 and the Future of American Industry,* Project for Strong Labor Markets and National Development, U.S. Senate Committee on Small Business & Entrepreneurship.

important engine of innovation, providing early-stage federal funding to companies such as Apple and Tesla, and investment in technology and research that helped U.S. companies pioneer the shale gas revolution. Rather than imposing tariffs that effectively tax the U.S. companies they are supposed to defend, the U.S. should support innovation at home by providing more funding for basic research and development, higher investment in talent development, trade assistance, and federal support for a series of "moonshot" programs in areas like biodefense systems, threat detection networks, and a distributed electric grid.[20]

[20] Laura Tyson, "U.S. needs to fight China with its own aggressive industrial policy," *Market Watch,* June 26, 2018, https://www.marketwatch.com/story/us-needs-to-fight-china-with-its-own-aggressive-industrial-policy-2018-06-22.

Chairman RUBIO. Thank you.

I just have one question, and I am going to turn it over to the Ranking Member, so all the members can get in.

Let me just start with Mr. Setser. What areas has China already overtaken in the United States on the global production value chain?

Mr. SETSER. I think, in general, China still lags. I think the most important area where China is approaching, if not exceeding U.S. capabilities, is when it comes to telecommunications networking infrastructure.

I think there is a consensus that infrastructure, which to be clear still relies on imported U.S. components, but their networking equipment is at the top end of the market.

I think in other sectors, China still lags, but China has clearly thrown tremendous resources at trying to catch up in semiconductor manufacturing. There is an over $50-billion national fund, and then there are multiple provincial funds that have over $100 billion collectively. That is an enormous war chest to try to catch up.

I do not think China is close to matching our capacities in aerospace, but aircraft is our leading export industry, and aircraft is our leading industrial export to China. So even though China has not yet caught up, their ambitions and efforts to do so should be a concern.

Thank you.

Chairman RUBIO. Ranking Member.

Senator CARDIN. Thank you, Mr. Chairman, and let me thank all of our witnesses.

All of you agree we should work in alliance with our friends on China. That is a little bit more challenging today because the President led on trade policies of aluminum and steel, which divided our traditional trading partners. So that when he went after China, we did not have the same degree of cohesion as we should have had in going after a country where we have legitimate concerns.

You all expressed that we should use the WTO, which is certainly a multilateral agreement. The challenge is that international property in governance issues are not terribly strong within the WTO, and how do we use that in the areas where China has exploited the fact that the WTO does not cover those particular issues.

Ms. Glaser, you mentioned TPP. TPP was negotiated in light of the fact that we were dealing with countries that are not market economies, and we had good governance sections negotiated within that agreement, which helped us deal with some of those issues.

Now, we are not a member of TPP, but we are looking at trying to advance trading relations with nonmarket economies with certain levels of requirements on governance, so that we can compete on a level playing field.

So I guess my question to you, how do we use the WTO more effectively in order to be able to reign in China's practices, particularly as it relates to intellectual property, as it relates to these tie-in agreements, as it relates to so many other areas that we had not been successful in blocking?

Yes.

Mr. ATKINSON. I, 100 percent, agree we need to use the WTO more effectively.

The Europeans just brought a very good case against China on tech transfer, which I believe we are not part of yet, which we should be.

I think we can put too much faith in the WTO. There is a very good article, a Harvard Law Review article by Mark Wu, looking at the inherent limitations of how the WTO is structured when it comes to China. The WTO is structured where it is a lot easier to bring a case when your counterparty has written something down on a piece of paper, and China knows not to write things down on paper. So they do forced tech transfer, but you cannot find the law. But everybody knows they do it. They steal our intellectual property, but you cannot find the law.

So I, 100 percent, agree we need to work more with the WTO.

I think the more important thing, though, is to embrace a very aggressive WTO reform agenda, which is what the Europeans want to do right now, and I think we need to be part of that, to reform the WTO to make it easier.

Even if we do that, though, I think we are going to have to think about this the way President Reagan thought about Japan in the 1980s, which was really about results-oriented trade.

We just cannot get China to stop using process because they can figure out ways to get around it. We have to focus on results-oriented, and that is going to require us to put together a very strong coalition of our allies and bring to bear force, not military force, but commercial force to press them to comply.

So I agree we have to do more with the WTO, but I think we have to go beyond that as well.

Senator CARDIN. But we have not seen from this Administration a reaching-out to our traditional trading partners in order to try to bring that type of pressure. It has been more America on its own.

So I agree with you. We have to use our collective power. The United States has a lot of power, but we would be stronger if we had our traditional trading partners in line with our trading policy.

Yes, Ms. Glaser.

Ms. GLASER. There may not be laws on the books in China, but the practice is clear.

I travel around the world and talk to other countries and CEOs of companies, and all that we need to do is some research and interviews.

I was recently in Canada, talked to a woman who had talked to the CEO of every leading Chinese—any—every leading Canadian company invested in China, and yes, they have all had to transfer some kind of IP.

So we can put together this database, and we have to work with other countries.

Senator CARDIN. Would that be actionable under WTO?

Ms. GLASER. I am not a trade lawyer, so maybe somebody else on the panel can answer that question.

Senator CARDIN. I mean, we know they do it.

Ms. GLASER. But I think the data is——

Senator CARDIN. We know they do it, but we have not been, as I understand, successful in stopping it under the WTO. And we have been told that the intellectual property protections under WTO are rather weak. So I think that is one of our challenges. I think to reform the WTO is critically important.

I just want to put one other issue on the table, and you can probably get back to us on it.

Mr. Atkinson, I think you mentioned specifically reforming the 7(a) program to try to make it more effective in dealing with international issues. I would welcome your suggestions on any of the SBA tools on how we can make them more effective to deal with the international challenges we have for small businesses, whether it is the traditional loan programs or the SBIR program and STTR program. It would be good if you could give us some help in how we could better tailor those programs to deal with these international challenges.

Thank you, Mr. Chairman.

Chairman RUBIO. Senator Romney.

Senator ROMNEY. Thank you, Mr. Chairman and Ranking Member. I very much appreciate the fact that you are holding these hearings and focusing on this very critical issue.

During my career, I had the occasion to work extensively in the textile industry, when there was one, and the automotive industry as well and, to a certain degree, the metals industry. I have long been an advocate of free markets and laissez faire, but I watched mercantilist policies not wipe out all those industries, although in the textiles almost completely wiped out the textile industry, and so recognize that we need to take a different course now as we look at many, many other industries that are facing a mercantilist strategy.

I would note that in my State of Utah, Micron, a U.S. chip maker, has some 2,000 employees. It is the only manufacturer in the United States of dynamic random-access memory, or DRAM. China paid employees in Taiwan to steal technology apparently from that company, and then a Chinese court banned Micron from being able to sell chips in that country, in China.

And so when there are practices of this nature going on, we can go to the WTO, perhaps if they have the provisions that will deal with something of this nature, but it can take a long, long, long time. And by that period of time, we are out of business, and someone else is in business.

I am looking to you all to offer suggestions as to action we can take beyond the WTO, action perhaps that we can take in this Committee or in Congress to actually push back against the kinds of policies that China and other nations have employed against us in the past, so that we do not just simply watch as industries that are critical to millions of Americans and critical to our economic vitality and our military capacity as those technologies are stolen from us and as those industries are stolen from us.

What is interesting is, in reading the report, we document all the terrible things going on but have very little to suggest as to what we should do about it. So I turn to you for any thoughts that you might suggest. If we could just go down the line here.

Yeah, Mr. Setser.

Mr. SETSER. So I think you outlined very lucidly the challenges that China poses, particularly in the DRAM sector and semiconductors.

We know China is subsidizing its own semiconductor industry. We know they are targeting U.S. companies, and we know there will eventually be a legal case for action.

The problem is that we have to wait for the impact of the action before we have the WTO case to file.

I do think, though, there are things we can do now. We are not terribly constrained by the WTO in limiting Chinese inward investment. We can, and we have, blocked Chinese attempts to acquire U.S. semiconductor technology.

We could expand that as a sanction to say, "As long as we know you are subsidizing semiconductors, we are going to take a more onerous approach to reviewing other investments."

I also think we should be documenting now all the various ways China is subsidizing its semiconductor industry and be prepared to initiate trade actions, but in the U.S. and at the WTO, to limit our imports of Chinese semiconductors, once those emerge, but also to pursue cases about the adverse effect. So if China is displacing our exports, we have some rights to take additional offsetting action. I think we can be pretty aggressive.

Senator ROMNEY. Thank you.

Mr. Atkinson.

Mr. ATKINSON. I could not agree with you more, Senator.

One of the challenges under U.S. antidumping laws, you have to wait for damage. By the time the damage is done, you are oftentimes dead, and it is meaningless at that point. We saw that, for example, in the U.S. solar industry, where we were the leader in the year 2000, and now we have got about 5 percent of the global market.

The Chinese actually—by dumping, they eliminated most of our solar companies, and then they used State government funds to go up and buy the assets, the intellectual property assets of these companies at 10 cents on the dollar.

We wrote a report on that—I will be happy to share with your staff—about a year and a half ago listing a very detailed set of specific policies that an administration could take or that Congress needed to pass. There are many, many things we can do that are not just tariffs.

Let me suggest one. You mentioned this case of Micron. This was a Chinese company, Fujian Jinhua. I am pronouncing it slightly wrong. Not only did they get stolen DRAM technology, but they were subsidized by the Chinese semiconductor fund by about $3 billion to build a giant DRAM factory, which no commercial company would ever have built on their own without a subsidy.

The Administration did a really smart thing, and they were able to ban the U.S. company selling them the equipment they needed to make the semiconductors. That company announced about 3 weeks ago that it was going bankrupt.

Now, we need to be applying that. The only reason they could do that is because somehow there was some connection to North Korea or Iran or something like that.

I would argue we need to expand that, and we should be able to block the sales of U.S. company equipment to these kinds of companies. We should be able to block their access to all of our banking and security systems. If a company has a very high likelihood of being based on big subsidies or stolen intellectual property, we should not let them use our banking and securities system.

And we should be able to block their imports and then work with our partners to be able to do the same.

Fundamentally, I think the only thing the Chinese government responds to is pain. We have negotiated and negotiated and negotiated for years, and they have shown that that does not really matter much, though I think there are specific things we could do.

Senator ROMNEY. Thank you.

Mr. Rush and Ms. Glaser, I think my time is up, so I am going to go back to the Chairman. Thank you.

Chairman RUBIO. Thank you.

Senator Shaheen.

Senator SHAHEEN. Well, thank you, and thank you, Mr. Chairman for a very thoughtful report. I look forward to reading it, but part of it recognizes the need for a coherent foreign policy, industrial policy, and trade policy and how we respond to China's actions.

It is not at all clear to me that we have that kind of a comprehensive policy, and I wonder—I guess I should start with Mr. Setser and Ms. Glaser, whether you think we have the kind of comprehensive policy that we need if we are going to respond to the competitive threat that China poses and what else we might do to better coordinate those tools of foreign policy.

Mr. Setser, do you want to go first, or Ms. Glaser?

Ms. GLASER. Thank you.

So my area of expertise is primarily China. It is not the United States. There are a whole lot of things China is doing. Some of them, we should not be doing. We are not an authoritarian country, but there are things that we can learn.

And I think it has been since the 1980s that we have really had a serious discussion, a discussion in this country about industrial policies, and I think that is something we should take a look at. What are the pros and cons of having some kinds of industrial policies providing trade assistance where necessary, for example, providing more funding for R&D, higher investment in talent development?

This is going to be difficult to see, but I will put it up. If you just look at where R&D in our country comes from, right? It is primarily increasingly from businesses. It is not coming from Federal spending.

Now, total R&D is increasing in our country. That is a good thing, but if we could get more Federal support for R&D spending, I think that would be one of the ways that we could compete more effectively with China.

And then I want to reiterate what Senator Cardin said. We really need to be working with our allies. When I talked to the Germans 5 years ago, they were not terribly concerned about the stealing of intellectual property. You talk to German companies now. We all are on the same page. We see the same problems. We dis-

agree about the solutions about what to do. So I think we really need to be talking more with our partners.

As we are more divided, which is what the Chinese want, it makes it more difficult to effectively compete with them.

Senator SHAHEEN. Well, I would certainly agree with that, and I would argue that we do not have an industrial policy in this country, and we have not had one for a very long time, and that that is part of the problem.

In fact, right now, we are not having any discussions with our allies in these areas—or in many areas, and that that is equally unhelpful.

Like some of my colleagues here, I was at the Munich Security Conference, and I think for the first time since I had been there over the last 10 years, there was real and deep concern about the threat that China poses economically and militarily.

So I think it is a huge challenge, and again, appreciate the Chairman's report for recognizing that.

I want to ask you—this may be—I think this is for you, Mr. Atkinson, but there has been a lot of—Huawei has been in the news a lot recently because of changes in China that have allowed—or that have raised questions about anyone who uses Huawei components and what that may mean with access to information.

Can you speak to how concerned you think we should be about that and whether small businesses should think about using other technology, other than what Huawei produces?

Mr. ATKINSON. Yeah. By the way, just quickly, one thing we forget, we had massive bipartisan support for competitiveness policy in the 1980s, which people forget. It was Republicans and Democrats putting in place a slew of laws, like SBIR/STTR, a whole lot of things. So we could go back to doing that again.

With regard to Huawei, I cannot say I am enough of a technical expert to say that. I think those are the kinds of decisions that folks in the intelligence community need to make.

Now, our U.S. intelligence and national security folks have raised significant concerns about Huawei equipment, and part of that is about, as we move into a 5G world, the attack vectors offer security, are harder in part because a lot of these networks now are what is called "software-defined networks," and so you do not just buy hardware. You buy hardware, but then the software gets always redefined. And that can introduce vulnerability.

So I cannot say yes or no, but I think it is important to have our government look at it carefully.

Senator SHAHEEN. But if we are talking about the theft of technology and of our competitive technology that is being produced by our companies, whether they are small or large, should not we be careful about anything that might create a problem in terms of the ability to keep that information confidential?

Mr. ATKINSON. Yes. I, 100 percent, agree with that.

Also, we testified in this Committee recently on how to help small businesses with cybersecurity, and I have to tell you, what SBA is doing in this is very, very limited. SBA really needs to step up their game in helping small companies get better cybersecurity. Some of the advice they are actually giving is actually wrong advice, if you are a cybersecurity expert.

So that is something we could do tomorrow. We could get SBA to work more carefully with small businesses. So we need both a defensive and an offensive response.

Senator SHAHEEN. Well, thank you. I would hope that as you are thinking about the information you can provide to Senator Cardin that you would also think about those kinds of areas where SBA could be more helpful to small business. That would be helpful.

Thank you.

Chairman RUBIO. And just to note, on March 13th, we will have a hearing on cyber and small business.

Just looking at Mr. Rush for a moment, I imagine if you had been the subject of an intellectual property theft early in your formation by a large state enterprise, you would not be sitting there today in your business, so you think about just that threat.

Senator Ernst.

Senator ERNST. Thank you, Mr. Chair, and thank you to our witnesses today.

It is good that we are taking time to discuss the threats and the challenges in the Made in China 2025 plan.

There are a lot of threats that are posed to the future of American industry, especially when it comes to our small businesses. So, again, this is a really important topic. I am glad we are discussing it today.

We do know Iowa produces a lot of ag equipment. That is really important to us, and ag machinery is one of the 10 targeted sectors in the Made in China 2025 plan. And it is a critical component of our U.S. industrial base, again, very important to my home State of Iowa.

Mr. Setser, in your view, what are the most important steps we can take to protect the agricultural machinery industries and other industries that are essential to the U.S. manufacturing base from the challenges China poses?

Mr. SETSER. Well, thank you for that question. I guess I am not entirely surprised that a Senator from Iowa might take a particular interest in agricultural machinery.

Senator ERNST. A very special interest, yeah. Thank you.

Mr. SETSER. I think, in general, we should recognize that China through its industrial policies has become an important competitor in a lot of the mechanical engineering sectors. Agricultural equipment has some similarities with construction equipment.

Senator ERNST. Absolutely.

Mr. SETSER. They draw on similar mechanical engineering expertise.

We often focus on the electronics and the high tech, but the agricultural equipment, the construction equipment, they are an important part of our manufacturing base, and they are threatened, as you noted, by Chinese subsidies.

I have noticed over time that our exports of construction equipment to China have gone down. Our exports of agricultural equipment have gone down, and I think China's global exports have gone up.

What can we do? Well, I think we have to use our trade tools—dumping, countervailing duties—where we have a case to go after Chinese subsidies, to offset the impacts of their unfair subsidies.

Senator ERNST. Right.

Mr. SETSER. And then I know it is a controversial topic, but I think in general—it may not be relevant for tractor exports, but it may be relevant for exports of construction equipment. Think about how we can use our export finance capacities.

Senator ERNST. Absolutely.

Mr. SETSER. Compete more with China in third-party markets.

Senator ERNST. I do think there is a role that can be played in balancing some of that to make sure that our small businesses can compete in that export market, especially against countries like China. So thank you for that. I appreciate that.

Ms. Glaser, one of the key components of our national power is, of course, the innovation in our small businesses that bring fresh ideas into our defense industrial base as well, and what we see is Chinese state-owned enterprises will benefit from government subsidies, just as we are stating with other types of equipment as well, and they unfairly compete with American businesses. And it does pose significant risk to us and to our future of our industrial base, supply base, the defense industrial supply base, as we move forward.

So, in your view, how can we combat this practice and take steps to ensure that there is fair competition for America's small businesses, particularly the ones in the defense industry?

Ms. GLASER. Well, again, my focus is primarily on China, and that is what I can bring to the table here and explain to you the threat that ultimately China poses. If you dig into the amount of subsidies that China is putting into every one of these 10 industries, the very specific goals that they have set in these areas, it is really mind-boggling.

You mentioned the agricultural machinery, so I will just go back to that for a second. One of their goals for 2025 is to have domestically made equipment to meet 95 percent of their domestic demand. So that goes back to the issue of localizing, subsidizing, and then capturing global markets.

In the defense area, the real challenge is that there is really no distinction in China between the civilian and defense, and it is increasingly deliberately integrated and fused. So if you are dealing with a civilian company in China, that is going to easily, very quickly spill over into the defense markets.

And you can see this in the aircraft space——

Senator ERNST. Right.

Ms. GLASER [continuing]. Where the Chinese stole basically the F–35 blueprints, and they have built their own military aircraft. In civilian aircraft technology, they lag way behind, and that is an area we have to really protect because Boeing is first going to face the challenges potentially losing the domestic market in China.

Over time, if China can produce first Narrow-Body, which they now have already the C919, I think it is, and then they are going to be building potentially a jumbo-body jet. And it will move from domestic into global markets. So we have to protect our intellectual property in these areas.

Senator ERNST. Thank you. I appreciate you making that point too, and thank you for your time here today. I think this is a really great issue, not just for small business, commerce, other areas, but

also for our Armed Services Committee. It is something we need to pay attention to. So thank you very much.

Thank you, Mr. Chair.

Chairman RUBIO. Thank you.

Senator Coons.

Senator COONS. Thank you, Chairman Rubio and Ranking Member Cardin. Thank you, Chairman, to you and the Committee staff for this valuable and insightful report.

I, like many of my colleagues, hear concerns regularly from companies from innovators, from manufacturers across my State of Delaware, in particular, with relation to IP theft, with some of the unfair subsidies, and with some of the ways in which we are not playing on a level field with China.

Rob, I particularly like your phrase "innovation mercantilism" to characterize that unique combination of inappropriate subsidies and IP theft and forced technology transfer.

Let me start, if I could, with you, Rob. Just in terms of our trade deficit, some are speculating that the U.S.-China trade dispute could conclude soon with an unfortunately small-bore deal that would simply be a commitment to purchase more agricultural products, which while very pleasing to the soybean farmers of my State and many others might miss an opportunity.

What is the relative importance of commitments by China to purchase more U.S. goods versus actually ending cyber espionage or government subsidies or other unfair practices you have characterized as being "innovation mercantilism"?

Mr. ATKINSON. I think it would be a vast mistake if we look over a deal that is based on reducing the trade deficit. The Chinese are more than happy to give us that deal. They would love to turn us into Canada or Australia that basically supplies raw materials to China. They take all the value-added, and they dominate the globe. That is what they would love to have, and if we accept a deal that is just about reducing the trade deficit with selling more commodity goods, I would argue we risk coming to be a country like Alexander Hamilton warned of drawers of water and hewers of wood.

Senator COONS. Bonnie, if I could, in terms of industrial policy, I think one of the things the United States has done that is successful is Manufacturing USA.

We have a national network of institutes, and in Delaware, one of them is headquartered at the University of Delaware, the National Institute for Innovation in Biopharmaceutical Manufacturing.

Made in China 2025 blatantly copies our successful Manufacturing USA model, and yet Congress has not authorized an extension or an expansion of funding or engagement in what has been—it was a very successful model for advanced manufacturing in Germany, which we proudly copied. We have not come close to their scale. The Chinese see it as a successful strategy for advanced manufacturing.

What is your view about whether we should be trying to extend and expand that program and whether or not Federal innovation support generally is critical to competing with China?

Ms. GLASER. Senator, I am not very familiar with the program.

Senator COONS. Rob, my hunch is you are deeply familiar with the program.

Ms. GLASER. My guess is that he is deeply familiar with it, so maybe he would be better suited to answer that question.

But I think there are industrial policies that have worked for some countries. We certainly have seen Germany's Industry 4.0 program that is working for them. The Japanese in the past have pursued industrial policies. So, again, I think this is something we should be looking into the pros and cons.

Senator COONS. It is a successful and intentional alignment of basic research——

Ms. GLASER. Yeah.

Senator COONS [continuing]. Applied research, workforce training, small startups, and spinoffs around university hubs in 25 cities around the United States.

Ms. GLASER. It makes a lot of sense. It sounds like the Chinese have copied the right thing.

Senator COONS. It is actually working.

Rob, I will ask you a last question, if I could. As you know, I have been an advocate for the Manufacturing Extension Partnership, a now decades-long program that helps with quality control, with manufacturing streamlining. About three-quarters of U.S. manufacturing firms are really quite small or fewer than 15 employees, and many of them are in the defense industrial supply chain. And there are very few Federal programs to actually help them get access to world-class skills to compete globally.

The President has actually tried to eliminate the MEP in the last two budgets. Why? And does it actually bring value, and what is its impact on the supply chain?

Mr. ATKINSON. Yeah, absolutely.

By the way, on the Manufacturing USA, the Chinese are on target to invest about 50 times more—five-zero times more—than we will be investing in that program.

On the MEP program, that is a program that has been around. Actually, when we talked about industrial policy in the 1980s, that is where that came from. There was bipartisan support to commit to that in the 1980s that President Bush supported.

That is a very effective program. All the studies show that it pays more for itself, more and many times over.

If you look at what our competitors are doing, the Canadians are investing 10 times more in their program for small manufacturers and share of GDP; the Germans, 20 times more; the Japanese, 40 times more.

I think the reason why the Administration has zeroed it out has absolutely nothing to do with its—the high quality of the program and its effectiveness. It is just they are looking for things to cut for other priorities. That is not a top priority.

I think it needs to be a top priority if we want to help our SME manufacturing base.

Senator COONS. If I could, in closing, Senator Cardin asked a question earlier about the SBA 7(a) loan program. I do have a bill with Senator Gardner that would specifically strengthen their small manufacturer loan programs, reduce the fees, expand the

scope of it, and something I would love to work with you on that I think would meet some of that identified need.

Thank you very much, Mr. Chair.

Chairman RUBIO. Senator Hawley.

Senator HAWLEY. Thank you, Mr. Chairman, and thank you also for this excellent, outstanding, and timely report from which I learned a lot, and I think it is hugely significant.

One of the most important conclusions, I think, which you have all touched on today, is that trade with a system that is based on what you have been calling, Mr. Atkinson, this "innovation mercantilism," can and will reduce our overall economic welfare, unless there are—in fact, it is happening right now, unless we make significant reforms. I think this is a very, very important thing to understand and needs to become a cornerstone of policy changes going forward.

In that vein, let me just return to a discussion you were having earlier with Senator Romney regarding various actions that could be taken to stop the forced technology transfers, the theft of intellectual property, and I will pose this to the whole panel, but I will start with you, Mr. Atkinson.

Might we consider a regime of IP sanctions, broad-based IP sanctions on China or at least affecting China where it might prohibit, just flatly prohibit American firms from entering into technology transfer agreements and prohibit our market, bar from our market, goods sold by industries that we have reason to believe have engaged in either theft or have demanded a forced technology transfer?

Mr. ATKINSON. Thank you.

Absolutely, we could do more to block Chinese sales of products where we know we have a pretty good estimate that it has been based on stolen IP, and I think we should do that.

There is also some other specific rules that we have laid out around how the Chinese force American companies doing business in China, to force them to share their technology around patents. We should—you know, tit for tat. Any Chinese company doing business in the U.S. should comply with the Chinese rules on that and see how they like that.

With regard to your point about forced joint ventures, that was litigated last Congress with the FIRRMA bill, and there was a big debate, I think as you may know, should you include JVs as part of the CFIUS regime, and the choice was to not do that, but to put that in BIS, the Bureau of Industry Security. And they have come up with their emerging and foundational technologies. If you are a technology on that list, you could not do a JV. It is not clear to me how many technologies will be on that list. It is a little bit of a crude measure because we do not want to cut off our nose to spite our face. We want to sell the Chinese our products, so we gain market share, but we do not want to give them our technology or underlying knowhow.

Senator HAWLEY. I would invite anybody else on the panel who wants to comment on this, on other measures we might take.

Yes, go ahead, Ms. Glaser.

Ms. GLASER. I would consider passing a law that mandates that companies provide information about what they are doing. It might

have to be provided privately, not necessarily publicly, but if they make a decision as part of a joint venture with a Chinese company, that there is some central place where we know what is going on, what are they transferring, and whether they have done so voluntarily, what kind of coercive measures were used.

There is also a set of things that are, I believe, included in legislation, recently introduced by Senator Kamala Harris, that would combat economic espionage, that would increase damages available for companies that are victims of trade theft, which would be very useful, I think, for SMEs; extending the statute of limitations for crimes, which apparently is fairly short; and expanding the scope of the Economic Espionage Act to cover cybercrime and hacking that take place outside of the United States so that civil suits could be brought against perpetrators that are working abroad.

So those are some of the things in that legislation that I think I support.

Senator HAWLEY. That is very helpful. Thank you.

Mr. Setser.

Mr. SETSER. Just a couple of ideas because I think we are all looking for creative responses. In aircraft, I think we might explore with our European partners something which has a little bit of the character of what you recommended.

Part of the reason why we enter into JVs is because China might give its business to a European company if we do not. If we worked with our European allies and sectors like aerospace where we are strong, maybe we could informally reach an agreement not to compete with each other in ways that end up helping China.

The structural solutions to the tech-transfer problem are, in part, getting rid of China's review on inward investment. So we can have wholly owned subsidiaries, but also getting rid of the Buy China preferences, which make it hard to export into China. If we are building products here and selling them to China, there is no tech transfer.

Senator HAWLEY. That is very helpful.

Go ahead. Mr. Atkinson and then Mr.——

Mr. RUSH. Yeah. What I would submit is that there are two sides to this coin. There are sort of defensive measures and offensive measures, and we are having a lot of discussion of how to sort of staunch the flow of IP theft.

I would submit that you could probably look at every single industry in China and say there is something going on there.

So perhaps what we should do is look at the Made in China 2025 plan that has targeted industries and spur innovation in those industries, especially on small businesses in the United States. Let us put more gas on the fire for those industries and maintain our edge, maintain the gap in between the United States, China, and others because, at the end of the day, that is actually the core of American industry is our ability to innovate and have world-class technology, not prevent others from ultimately using that technology.

Senator HAWLEY. Thank you very much.

I see my time has expired. Thank you, Mr. Chairman.

Chairman RUBIO. Senator Hirono.

Senator HIRONO. Thank you, Mr. Chairman.

So, Mr. Rush, you were talking about that we need to put more emphasis on supporting those kinds of innovations that can directly compete with China's efforts to take over the world economically. So maybe one of the ways is for us to really put a lot more emphasis in programs like SBIR and STTR, which we have supported. There is not that much money that goes into these programs in the scheme of things, not in the kind of scale that you are talking about.

You also mentioned, Mr. Atkinson, that we need to help these entities that have these grants or loans to commercialize. So how do we do that?

Either one of you.

Mr. RUSH. I think that one of the really powerful things about SBIR is that it helps us go from idea to working prototype to something that can be picked up, and one of the ways I think that we can help sort of get over that commercialization hump is simply the government recognizing its power as a good customer and maintaining focus on the commercial aspect of these SBIR/STTR and other programs and looking not just at the sort of program office that might be running any given SBIR contract, but almost a whole-of-government approach and saying who might use this really interesting thing and incentivizing folks within the government to pick those things up as well as looking at things like ICOR, the ICOR model to help companies that are new in this regime to do better customer discovery along the way with the SBIR, with the SBIR program.

The other thing that maybe we would recommend is going faster with SBIR, that it is allowing companies to go faster, because for certain industries, the time frame of SBIR Phase I and Phase II and Phase III is simply way outside the decision-making process and the innovation cycles of these industries. Even within aerospace, an industry that has relatively long design cycles, we are finding that the SBIR is longer, and that is something that it is an opportunity for us to modernize.

Senator HIRONO. Is that time frame by regulation, or how do we fast-track?

Mr. RUSH. There are two aspects—or maybe two or three aspects, the delta between proposal submission and getting on contract.

Senator HIRONO. So is that by regulation? It is not by law, is it, that——

Mr. RUSH. I believe it varies according to agency.

Senator HIRONO. Okay. So we probably should talk with you a little bit more.

Did you want to add something, Mr. Atkinson?

Mr. ATKINSON. Yes, a couple things. One is our understanding is SBIR awardees are not allowed to use that money for commercialization activities.

Senator HIRONO. Okay.

Mr. ATKINSON. There has been legislation in the Senate to allow them to use a small portion of that for commercialization, and that is one thing we could do.

Senator HIRONO. Okay.

Mr. ATKINSON. Another idea that we have proposed over the last few years is an additional add-on. So we have SBIR, which is a portion of Federal extramural R&D. We have STTR.

We propose something called SCNR, spurring the commercialization of our Nation's research, and it would be about .5 percent. And that money would be used to fund universities and State governments who are engaged in technology commercialization activity. Hawaii is doing that. Most all states have these programs to help their universities and their Federal labs do a better job of getting that technology out in the marketplace in the hands of small companies.

But it is hit and miss. There is not enough resources. That is something the Federal Government could do that I think would help with that.

Senator HIRONO. So is there a bill that creates another program?

Mr. ATKINSON. There is not a bill, but I would be happy to work with your office.

Senator HIRONO. Oh, certainly. There you go. I like that.

Mr. Rush, you said something that was really interesting to me. You said that China is developing technology to beam power from space. I mean, this is power to electricity and all of that, and at the same time, so many are still looking at wind and solar and those things.

How far away is China from developing this kind of ability, and what does it mean for our country that they are doing this and we are still Earth-based?

Mr. RUSH. Yeah. So, broadly, this is a real thing, the ability to basically collect solar energy and then convert that into either microwaves or lasers and send that down to ground stations on the ground.

China has been pretty public in saying that by 2025, they want to have demonstrations of this, and then they want to have facilities that are gigawatt-class facilities on orbit in the next couple of decades, which could represent a complete break from traditional terrestrial sources of energy. And it is something that honestly would be worthwhile to look at from an alternative energy perspective in the United States as well.

Senator HIRONO. Could I just, Mr. Chairman, one last question to Ms.—is it Glaser? Glaser.

So you said that U.S. companies who are in China basically have to transfer some kind of IT for that privilege, and I like your idea that there should be some disclosure. But Chinese company entities are buying U.S. companies, and that is under the radar screen. They buy up our stocks and all that. Pretty soon, they will own much of our U.S. companies.

So should we require—there may already be some limitations on how much stock a foreign company can own of U.S. companies, but is there something that we can require of Chinese companies that buy up our companies?

Ms. GLASER. Well, I certainly think we need a better system for review of what the Chinese are trying to buy, and again, this is something to be working on with our allies.

The Chinese are buying companies all over the world, and this will enable them to dominate supply chains potentially.

And we have, of course, seen this, as they have surged ahead in innovation, in Huawei and CTE. Now we have Nokia and Ericsson are the only two companies that are left that are doing this comprehensive telecommunications infrastructure, and Motorola is no longer in the game.

This is an area where we have to prevent China from dominating these supply chains, and we should be coordinating so that we know what kind of activity the Chinese are looking, what companies they are buying.

Senator HIRONO. Are we coordinating that kind of an effort?

Ms. GLASER. Not as far as I know.

Senator HIRONO. Thank you.

Ms. GLASER. Perhaps Brad or Rob know something more about this.

Mr. SETSER. We do have the CFIUS review process for foreign investment in the U.S., and that was modernized.

I think there is certainly more we could do to coordinate with our allies. I think the Germans are moving toward a similar system, a national security review. So there is room to do better there.

Ms. GLASER. One thing that I would add is that the German government is either considering or has already decided to set up a fund to help companies that are struggling in Germany so that they can succeed rather than be bought out by the Chinese.

Senator HIRONO. Thank you.

Chairman RUBIO. Senator Risch.

Senator RISCH. Thank you, Mr. Chairman.

Chairman RUBIO. Our Chairman Emeritus.

Senator RISCH. Yes, Chairman Emeritus.

[Laughter.]

I apologize for being late to this. There were some things I really wanted to hear on this, but we had the Idaho Potato Commission in town. And when you are from Idaho, you set all things aside and meet with the Idaho Potato Commission.

Mr. Setser, they tell me you talked a bit about Micron Technology and made some observations on that.

Let me tell you. Micron Technology—this is the Small Business Committee. I remember when Micron Technology had three people working for it, the three guys that started the company. It was in a garage and eventually moved to the basement of a dentist's office and then moved on, and the rest is history.

And now they are caught in an international matter that I guess you talked about, and that is really the question I have got for you.

I have been pressing this as hard as I could. I met with a Chinese ambassador, amongst others, and he attempted to defend the undefendable, but what they are doing is just not acceptable. If China is going to become a world player, if they are going to become something on the world stage that they want to be to make life better for their people and want to compete, look, we compete. But you got to do it under rule of law, and they are not even close right now.

What I have been telling people is, look, this Micron case is one we need to draw a line in the sand on. This is one that if they can do this, look out. If everybody has read 2025, everybody knows that the microchips are one of their short commodities. Well, so bet it,

and we expect that they would learn to make it and do it either through licensing or according to the rule of law.

What is your vision? What happens if the Chinese win this one? How do you view they go forward with their 2025 initiative?

Mr. SETSER. Well, that is obviously an important question.

Right now, as I understand it, there are three major producers of DRAMs. Micron is one. There are two South Korean firms.

Senator RISCH. They are second. Micron is second.

Mr. SETSER. Second.

China, I think, intends to enter this industry with massive subsidies, drive down prices, and at a minimum make sure that the bulk of the memory chips used in Chinese products are made in China.

I think China would obviously love to be able to buy, after depressing global prices, one of the three incumbents. They clearly have already tried, as you know, to buy Micron. They clearly have already tried, as you know, to effectively steal Micron's technology through their partners in Taiwan. It is clearly an egregious case, and I agree with you. The question we now face is how do we respond, and I think we have to be very proactive in identifying how China is currently subsidizing the semiconductor industry and thinking creatively around the set of sanctions.

The legal case that the Department of Justice has brought against the Chinese company directly involved in the theft has been very effective, but China has multiple companies trying to enter the DRAM market. We have to think creatively about how we respond as those subsidized competitors undermine our position in global markets.

Senator RISCH. I really appreciate that, and I think this is going to be a whole-of-government approach to this thing, whether it is Justice, Treasury, or Commerce or what have you. But that pressure has got to stay on, and they cannot get away with this. If they do, this thing is heading for a very bad place.

Mr. SETSER. Can I just add one other point, which is another company we have discussed? We have certainly discussed Huawei and the information security threats that it poses, but Huawei has become very central to China's domestic industrial ambitions in the semiconductor business.

It is designing more and more of its own chips. It seeks to displace imported technology from its network equipment and from its cell phones. I think that is something we need to watch very carefully.

Senator RISCH. Thank you.

Thank you, Mr. Chairman.

Chairman RUBIO. And I will use the few more minutes, before we can wrap up here, but since I did not use the first part, let me just start with this.

There is a sense that—and this has been the way it has been for a long time—is that the private sector should be stepping forward and doing these things on its own, and that when it comes to China's attempts to dominate high-end industries, that market engagement should be outside the scope of government's role.

I would ask you, Mr. Atkinson, what are the drawbacks to such an approach, in light of what we have discussed here today, and

particularly for small businesses who are in a—they are caught in a nation-against-nation economic competition. This is not a small U.S. business competing with a small Chinese business to see who has a better idea. This is a small or midsized U.S. business trying to innovate and compete against a potentially small firm, backed up by a nation state with the second largest economy, soon to be largest per capita—not per capita—largest gross economy in the world.

That is not a fair fight. So what are the drawbacks of not having some level of government engagement? Not industrial policy where we are doing the same things they are doing, but the sort of things we have discussed today, allowing them access to the U.S. Government, being their customer, that sort of thing.

Mr. ATKINSON. Senator, I think you hit the nail right on the head. There are two big challenges that a small and even a large firm would have.

The first is that you really have very little access. You cannot go to a Chinese court because they are just not going to decide in your favor. We have seen that in case after case where the Chinese court always decides in favor of the Chinese company and against the U.S. company.

The second big issue is that you are dealing with cases where, for a small company, who do they talk to. Where is the place in the government where they go? We really have to have better systems in the U.S. so that any small company can get the right access in government and then get action taken on their behalf, and that right now is very haphazard. You are lucky if you can find the right person. You are lucky if that person then will take your case and sort of wind its way through the government.

We do not have an all-of-government or whole-of-government approach to help small companies be able to deal with this.

Chairman RUBIO. Mr. Rush, just talking about that, Made in Space, which you got seed funding from the Small Business Innovation Research program with NASA and the Department of Defense, correct? What role did that—I mean, I guess my question to you, could you have done what you did without it, and what role did it generally play in taking you to where you are today?

Mr. RUSH. Yeah. I would say that from a broad perspective, Made in Space would not be the company it is today without SBIR and without the support from NASA and other government agencies in various ways.

We took to heart that sort of seed funding mantra, however. Like we want to be commercial and government. In the aerospace industry, there are lots of folks that are just exclusively government, and we see the value of being both.

But in so many ways, the infrastructure that exists in aerospace and in space specifically is enabling of this innovation. Without the International Space Station, we would not have been able to for single millions of dollars demonstrate and productize the technologies we have. It would have cost two orders of magnitude more money to do it.

SBIR is a really important part, but it is not the end of it. Having those on ramps into commercial utilization, encouraging small businesses to look elsewhere besides just the government, as well

as saying—as well as encouraging and introducing small businesses to other parts of the government that might benefit from the technologies under development in SBIR, I think would be prudent.

Chairman RUBIO. And to me, the whole notion about providing opportunities for new entrants into the field is critical, obviously because of the nation state competition, but also because of a concerning trend line we have seen in terms of business investment in innovation, where you have seen a significant percentage of profits increasingly returned to shareholders, which is not inherently evil, but it is happening in many cases at the expense of being reinvested into research and development to pursue new lines of work.

So part of it is creating demand, so that there is attractiveness for that investment to happen, but the other is when you have a small innovative idea somewhere, giving them the opportunity to be successful, especially if a larger marketplace presence is not doing that. These programs seem pretty critical, especially if we can prioritize how we use these programs to key industries that are critical to our future.

And I would say this Made in China 2025 and the 10 industries there are a good starting point for the kinds of places that we need to be supporting at least for these opportunities.

There has been talk about—Mr. Setser, I wanted to ask what—on the WTO, it is an imperfect tool, not that it is a useless tool, but there are some imperfections in using it when it comes to China. What does their unique state-driven economic structure—what challenge does that pose to the ability to use the WTO to address all of its behaviors?

Again, not implying that it is useless, but there are some impediments to using it because of how they are structured; is that correct? And if you could talk about that a little bit.

Mr. SETSER. Yes, I would be happy to do so.

One of the aspects of China 2025 that is sort of right out there in the open and in your face are these market share targets. They look like quotas on imports, but they are not structured as quotas on imports. They are in formal documents out of China's state planning process that somehow gain force in the Chinese system without being legally binding because China owns such a large share—I mean China's government owns such a large share of the economy.

Take aircraft, sort of the obvious one. The three major airlines are all state-owned. Hainan Airlines is not state-owned, but its parent company relies on the state for financial backing.

China does not need to have a formal quota on how many aircraft it imports. It just needs to send instructions through various channels to the companies, the commanding heights of the Chinese economy, and you can effectively be shut out of the Chinese market without necessarily having a clear-cut WTO violation.

With subsidies, we have discussed some of the difficulties. You have to wait a long time in order to show that there has been a material damage to you before you can formally bring the case.

Chairman RUBIO. If you are still in business by that time.

Mr. SETSER. If you are still in business, but there is also a problem identifying a subsidy. It needs to be a specific subsidy, and in

the Chinese system, it is hard to identify the specific subsidy when everything in a sense is subsidized.

If there is a state-supported investment fund, we would all think that is a subsidy, but unless you can prove that the investments were made on noncommercial terms, you do not necessarily have a case. So it is that difficulty in applying the WTO's rules to the Chinese system, which have created this plethora of problems for us as we try to sell into the Chinese market.

Chairman RUBIO. Mr. Atkinson.

Mr. ATKINSON. Let me just say quickly a story a couple of years ago when I was talking to the chief counsel of a Fortune 100 company. He was explaining to me that the Chinese were systematically stealing their technology. He went and had a face-to-face with the minister who was relevant to that area, and he was told by the minister—the chief counsel said, "If you do not stop this, we are going to bring a WTO case," and the minister said to him, looking him right in the face, "If you bring a WTO case, you will never sell another product of yours in China again." And needless to say, they did not bring a WTO case.

Chairman RUBIO. Just on that point, a lot of talk about Huawei, and we are hearing now the concerns about telecommunication infrastructure around the world. What we are seeing now is, despite these concerns, numerous places where there are dominant telecom presence, are pushing back on locking them out, and one of the things we have learned, one of the rationales behind it is that their existing equipment in the network relies upon annual or biannual software updates and upgrades that belong to Huawei.

So if, in fact, they take this public position, they are going to go through an incredibly disruptive moment in which they are going to have to rip out all of that stuff. They are going to have to go through a period of time where they do not have that latest update as they transition to a non-Chinese company.

It is incredibly disruptive for a Western company who has to answer to shareholders and the general public. So the leverage—we should not underestimate the amount of leverage that they hold, not just about bringing actions, but about the fact that despite something being damaging to the national interest or even the long-term future of a company, the leverage in the short term is enough, either denying the market access or denying them access to software upgrades.

That is critical. It is almost, in some ways, like arms sales. When you buy a nation's weapons systems, you are tied at the hip for a significant period of time because of spare parts and training and the upgrades to it.

My last question—and I know—I think that while we are focused on the small business community in this Committee—that is our jurisdiction—and all of the trade talk really focuses on the big picture of trade and the big numbers, small businesses are the ones that would pay the biggest price, especially down the chain on it of trade, and they do not get nearly as much attention or coverage in the financial stations on television and the like. Most of them are not publicly traded, and so they are also not being speculated upon constantly in the Wall Street Journal or CNBC or the like.

I guess my biggest concern is that in these trade negotiations that are largely focused on the overall trade imbalance, having a deal that basically deals solely with that, with concessions where China promises to purchase more American agricultural, more soybeans, which that would be great. I want our soybean farmers to be successful, but it does not really deal with the overwhelming majority of other aspects of our trade relationship, especially for the long term.

So to what extent would trade balance-focused concessions such as that address our economic imbalance, especially for small businesses within the scope of what we have discussed here today, if that is all the deal did is just find more balance in the big-picture number but did not really deal with the intricacies of individual industries, particularly those like yours, Mr. Rush, and others who are outside the scope of such a concession?

It is a jump ball. All right, Ms. Glaser.

Ms. GLASER. I will just make a few comments, Chairman Rubio.

I think it is important to look at the full scope of the problems that businesses have in China, and they really begin not with forced technology transfer, to be honest with you.

If you look at the AmCham Survey that just came out of U.S. companies that are in China and if you look at surveys of U.S. companies that export to China, you will actually find it is pretty low on the list. They are really concerned about market access, and there are a lot of things there that we can do instantly that we could put pressure on China that need to be part of this deal.

So in this recent AmCham Survey, 53 percent of the companies that were surveyed said we need to increase the transparency predictability and fairness of the regulatory environment. This is really all about nontariff barriers for them, and then IP protection is number two.

So we have to look at various ways, I think, that we can deal with these set of things.

From what I heard about USTR Lighthizer's testimony this morning, it sounds like we are going back to where we were in 2015–2016, where we were negotiating in the strategic and economic dialogue, a series of things that China could do to protect intellectual property, to open up market access. If they actually did all of these things, it would be a step in the right direction.

If all we do is get promises on paper and then the Chinese buy LNG and agricultural goods, then we will have squandered what I think is an enormous amount of leverage that actually President Trump has tried to build.

Chairman RUBIO. I would just say the concessions you are talking about go at the heart of their industrial strategy.

Ms. GLASER. Yes.

Chairman RUBIO. In essence, we were asking them to walk away from key components of what they intend to do.

Ms. GLASER. Maybe the Chinese are in my phone.

Chairman RUBIO. That is what happens when you bring a Huawei phone in here.

[Laughter.]

Mr. ATKINSON. I would actually argue that forced tech transfer is more important than that. There is a reason companies do not always put it on a survey.

For example, there is a recent academic study that showed that there were 6,000 new international joint ventures in China. There is another study that showed that Chinese companies have gotten significant intellectual property from joint ventures, not just the company that was the joint venture tech transfer partner, but there are other companies in that same industry. So there is a lot of good evidence that forced tech transfer has made a big improvement.

Senator, to your point, under international economics, there is a notion of division of labor. We are a rich country. We have a lot of intellectual property assets. We should be specializing in high value-added technology-based products. Other countries specialize in more commodity-based products.

The idea that we would somehow balance our trade by only selling oil and gas and some commodity products, I think would—it violates what international trade theory says. We should be the ones that are leading the world in high technology, high value-added products. So I think any trade deal that would settle for just a trade deficit reduction, it would be a mistake.

Mr. SETSER. Let me add a very concrete issue, which could be at the center of the negotiations.

China maintains procurement lists for medical equipment, procurement lists that favor products made in China. If U.S. firms were free to transfer technology, they could potentially qualify for those procurement lists by producing in China. That is better than not selling at all to China, but it would be even better if products made in the U.S. could be freely purchased by Chinese hospitals. That would support more small business here at home.

Top-end medical devices have historically been an important U.S. export strength, and I personally think addressing those barriers to U.S. exports needs to be at the center of our trade agenda.

The other point to make is that China's own economy is a point of weakness. There is a risk, at least in my judgment, that if China does not put its own community on a sounder basis, China could be tempted to go back to an export-based model.

While our current trading relationship with China is far from perfect, we would be much worse off if China reversed the rebalancing that has taken place after the global financial crisis, went back to looking to exports to support its growth, and then many small businesses would face even larger challenges.

Thank you.

Chairman RUBIO. Well, just at the core—and we will wrap it up—the basic core of this is it is nearly impossible to make something somewhere else and then sell it inside China, and it is very difficult to invest and produce in China for the Chinese market unless you joint venture with someone in China, where you run the risk of having your intellectual property stolen.

So the first point is it is nearly—very difficult to impossible in most key industries to make it somewhere else and send it in. So if you are not even in there, they cannot steal your IP. They could, obviously, from here, but they cannot force the transfer.

But if you do get in and they allow you in, you run the risk that within a number of years, once they figure out how to do it, they put you out of business, and that is at the crux. And that is what we are going to ask them to change, and I think that is a heavy lift but most concerning of all for small businesses.

Do you have anything else?

Senator CARDIN. I want to thank the witnesses. I thought this was extremely helpful. It is clear the challenges here are multiple. We clearly need to take action against China's unfair practices, whether we try to do that under an existing WTO, improve the WTO, or take action here or take action in conjunction with our trading partners. We cannot sit still as they are stealing intellectual property or they are doing things that are clearly in violation of international norms.

But we also have to be better prepared, and I think this Committee particularly, with the tools we have under the SBA, we need to see whether we can fine-tune them.

I was impressed by how important the SBIR program was for you. We have the STEP program to help exports. We can certainly look at that program and see if we can improve it.

Looking at traditional programs such as 7(a) or 504 as to how they can be more effective, looking at the SBIC as to a source to help small businesses, I think all of that, this Committee can play an important role.

But the bottom line, as the Chairman has pointed out, is that the strategy of a controlled economy such as China with their ability to control all the knobs, they have a strategy that has certain results, and those results are very clear. They are going to achieve certain levels without imposing legal conditions that could be raised as objections under WTO. They will do it by their government reactions to their businesses.

So it requires us to be more sophisticated. It does require us to work with our trading partners, our allies. It is critically important that we join in alliances, but we have to really recognize if we do not do this, we are in danger of really jeopardizing the economic strength of this country.

Chairman RUBIO. Thank you for that.

As we wrap up this Committee, we are facing, as we have talked about, a whole-of-government challenge. Ours has to be a whole-of-government response, and that includes the programs of the Small Business Administration. So that is what we are going to be focused on very much is ensuring that the programs and the policies under the jurisdiction of this Committee support the ability of small businesses in America to compete in the 21st century, which increasingly means compete in a nation state-level competition.

I want to thank all of you because I think a lot of ideas came from the testimony today. You saw a couple members take away some ideas that I hope will be part of our ongoing work over the next 2 years.

The hearing record for this is going to remain open for 2 weeks, and if there are any statements or questions for the record, they should be submitted by Wednesday, March 13th, at 5:00 p.m.

Again, I thank you all for being here, and with that, this hearing is adjourned.

[Whereupon, at 4:11 p.m., the Committee was adjourned.]

APPENDIX MATERIAL SUBMITTED

Senate Committee on Small Business and Entrepreneurship Hearing
February 27, 2019
Follow-Up Questions for the Record

Questions for Mr. Robert Atkinson

Questions from:

Chairman Rubio

QUESTION 1:

How would you define the optimal role of the federal government in national economic development?

This is clearly a broad question which I tried to answer in detail in the recent ITIF report "The Competitive Edge: A Policymaker's Guide to Developing a National Strategy." In addition, ITIF has developed a framework for thinking about this, what we term the national economic growth policy pyramid. At the base level are key framework conditions: factors such as the rule of law, ease of doing business, competitive markets, flexible labor markets, effective protection of property, including intellectual property, and a culture of trust. Without these key framework conditions, even the most sophisticated innovation and competitiveness policies will not succeed. The next level above these basic framework conditions includes an effective tax, trade, and investment environment. Key considerations here are establishing a globally competitive tax environment and implementing policies that enable trade and foreign investment, including policies to push back against foreign unfair trade practices. As these factors are in place, nations need to then focus on the next level above which comprises key factor inputs: the kinds of external factors firms need in order to succeed. These include robust physical and digital infrastructures (e.g., transportation systems, broadband, etc.); a skilled workforce with broad-based general capabilities but also the specialized skills matching the needs of key industries (e.g., increasingly computer science and machine learning skills); and robust knowledge creation (e.g., government investment in scientific and technological research). But even these are not enough for success. Indeed, with more nations realizing that mastery of these three levels is what is needed just to "be in the game," success requires going beyond this, to a fourth level, that includes effectively crafted innovation and productivity policies specifically tailored with regard to a country's competitive strengths and weaknesses. Policies in this category include provisions such as R&D tax credits, export financing, support for regional innovation clusters and sectoral industry research alliances (like the Manufacturing USA program), and support for innovative small businesses (like SBIR and STTR). These do not and should not imply a heavy hand of government picking particular firms as champions or particular narrow technologies to target. But that also does not imply doing little or nothing.

QUESTION 2:

What role can programs administered by the SBA, like the Small Business Investment Company (SBIC) program and Small Business Innovation Research (SBIR) and Small

Business Technology Transfer (STTR) programs play in driving investment in early-stage innovations?

In my view all three programs play key roles in helping spur innovation and tech-based competitiveness. As proposed in Senate legislation, I believe that more should be done to help ensure that these programs do a better job of spurring innovation in places other than the leading tech hubs of the nation (e.g. Boston, Seattle, Silicon Valley, etc.). Perhaps one way to do that, at least for SBIR and STTR, would be to give additional prioritization and points in scoring to small firms located outside of the top 10 or so more innovative regions.

QUESTION 3:

In your testimony, you discussed introducing an Open Commercialization Infrastructure Act that permits private use of bonded facilities for certain activities related to entrepreneurial education and training, as well as for economic development and job creation. In your estimation, were such an Act to be introduced and provided for small businesses under the definitions defined by the Small Business Act, what kind of impact would this change have on entrepreneurs and small businesses in terms of growing their businesses?

It is not clear what the impact would be, but one can make a compelling argument that such a change would help small business more than bigger businesses because the former have fewer in-house resources for innovation and therefore would benefit more from the ability to access these facilities.

QUESTION 4:

In the FY 2019 National Defense Authorization Act, changes were made to the SBIR and STTR programs to provide for greater commercialization of SBIR and STTR technologies, including allowing a larger portion of awards to go to commercialization and technical assistance related to commercialization. In your estimation, how much of the overall SBIR and STTR program funding should go to commercialization efforts?

In addition to permitting SBIR awardees to increase the share of funds they can allocate to commercialization-oriented activities, the federal agencies making SBIR awards should do the same. Though some participating agencies offer SBIR/ STTR award "supplements" to awardees to select their own vendors (or offer commercialization programs organized by outside vendors), these are capped at $5,000 per year per awardee for commercialization activities and cannot be used to fund company employees specifically devoted to these activities. Ideally, all agencies would allow this and commercialization award supplements of at least $10,000 and ideally up to $20,000.

QUESTION 5:

Your testimony also discusses focusing SBA's lending programs on traded sectors, noting that the current percentage of loans going to businesses that are traded is approximately 7.5 percent. What would you deem as a necessary percentage of loans in traded sectors for the 7(a) program to make a real impact?

While there is no exact ideal number – more is better – I would challenge SBA to have at least one third of their loans to traded sectors within the next several years, ideally increasing that share to half.

Answers to Questions for the Record Following a Hearing Conducted by the Senate Committee on Small Business and Entrepreneurship on February 27, 2019

On February 27, 2019, the Senate Committee on Small Business and Entrepreneurship convened a hearing at which Andrew Rush, CEO of Made In Space, Inc. (Made In Space, MIS), testified about MIS's work and its future plans. After the hearing, Senator Rubio submitted questions for the record. This document provides MIS's answers.

Questions for Mr. Andrew Rush

Questions from:

Chairman Rubio

QUESTION 1:

How critical was SBIR and the various other federal programs to the growth and success of Made in Space?

MIS Response:
Made In Space, Inc. (Made In Space, MIS) has benefitted enormously from a virtuous cycle of technology development and operation enabled by the Small Business Administration, NASA, and other government agencies. Continuous technological innovation has been foundational to maintaining America's commercial and military superiority on the ground and in space. Made In Space is developing technologies and business models that will enable and drive people to one day sustainably live and work in space. In 2014, Made In Space hardware successfully produced the first functional objects manufactured off the face of the planet. Today, Made In Space has several in-space manufacturing programs underway and is commercially manufacturing for customers aboard the International Space Station.

This success would not be possible without the Small Business Innovation Research Program, public-private partnerships like the In-Space Robotic Manufacturing and Assembly Tipping Point Program (IRMA) and access to the International Space Station. Made In Space strongly encourages continued support of programs which enable the step-by-step development of new commercial space capabilities, including the SBIR program, NASA's IRMA program, DARPA's support of in-space manufacturing and assembly development and the International Space Station.

QUESTION 2:

Having moved through the SBIR application and award and contract process, what could be done to improve the program; in particular, what would you consider appropriate timelines for the award and contract process versus your experience with the program?

MIS Response:
The single best thing the government can do to promote the growth and success of groundbreaking companies like ours is to be a good customer. That means –

- Buying commercial to begin with;
- Having a purchasing process that is as clear, easy and fast as possible; and
- Stating a need, and letting commercial companies figure out how to meet it, instead of having government trying to design the product or solution for itself.

Timelines for the award and contract process would be improved if they more closely resembled commercial contracting timelines. Specifically, contracting processes for SBIR Phase III awards that currently require months could be completed in days or weeks in a commercial setting.

QUESTION 3:

In your estimation, how much would a firm's commercialization objectives become more attainable with more efficient and timely award and contract times?

MIS Response:
More efficient and timely award and contract times would materially contribute to attaining Made In Space's commercialization objectives. Improved contract process would accelerate advancement of Made In Space technology maturation and improve Made In Space's ability to bring its space technologies to market, thereby enabling the capability to be available to NASA and other government agencies, but sustained by the commercial market, resulting in more cost effective and better technological outcomes for the government.

QUESTION 4:

What other suggestions, if any, would you have for improving the SBIR program?

MIS response:
Based on the successful demonstration of gravity-independent 3D printing on board a parabolic aircraft in 2011, Made In space was awarded SBIR contracts to develop the technology for demonstration aboard the ISS. Via an SBIR Phase III contract with NASA, Made In Space built and operated the first 3D printer to operate in Space. Thereafter Made In Space built the Additive Manufacturing Facility (AMF), a second-generation, more-capable 3D printer that was

launched to the ISS in 2016. Via Agreements with NASA and the Center for the Advancement of Science in Space (CASIS), the managers of the ISS National Lab, Made In Space owns and operates the AMF, routinely sending print jobs to the ISS and manufacturing them on a weekly basis. The AMF print services business is profitable and has produced parts for NASA, the U.S. Navy, Lowe's, universities such as Texas A&M University, student groups and even individuals. These uses represent pathfinders for future commercial space station-based businesses, a future cornerstone of American industry's utilization of space.

Expanded utilization of SBIR Phase III contract vehicles to support flight demonstration missions and infusion into operational missions will ensure maturation in technology areas that are crucial to maintaining America's competitive edge in space such as defense, research and development and technology demonstration that are often too niche or too early stage for significant private sector investment.

QUESTION 5:

In your experience, what does it take to be an innovative American producer in the 21st century?

MIS Response:
First, innovation. Second, it takes a relentless commitment to excellence: world-class talent, state-of-the-art manufacturing processes, and dedication to anticipating and meeting the customer's needs.

Made In Space innovations have triggered industry and government leaders to rethink the designs objects that will be sent to space. This innovation has been enabled by the support of the Small Business Administration, NASA and other government agencies. Made In Space is grateful for that support and proud to continue innovating with the support of NASA and other agencies.

Additional investment in innovation and accelerated operational mission infusion are necessary to in space to enable the innovations and maintain the relentless commitment to excellence that will maintain America's innovative edge in space.

Senate Committee on Small Business and Entrepreneurship Hearing
February 27, 2019
Follow-Up Questions for the Record

Bonnie S. Glaser
Director, China Power Project
Center for Strategic and International Studies (CSIS)

QUESTION 1:

What would pursuing actions at the WTO accomplish that Section 301 actions do not? Namely, what could the WTO do to increase the costs of China pursuing Made in China 2025 more than Section 301, which has put tariffs on its largest market for exports?

Using section 301 exposes the US to retaliation via the WTO dispute settlement process – and the Chinese have already embarked on that path. If the US took a case directly to the WTO and won, the Chinese would be in a much more difficult position. They could not legally retaliate. There have been 22 cases brought against China in the WTO and China has in most cases complied with the rulings. Using Section 301 is unilateral and using the WTO is consistent with our multilateral obligations.

There are pros and cons to each approach. Using the WTO has the advantage of giving us the moral high ground and the opportunity to take action without retaliation (or making China the outlier if they retaliate anyway). It would also create an opportunity for us to build a coalition, since other countries could join in our complaint or bring similar complaints of their own. Collective action would put more pressure on China than our unilateral action. The disadvantages of using the WTO are that the process takes some time, probably a year or two at best, and the outcome is uncertain. In addition, ironically, if the US persists in its strategy of trying to render the WTO's Appellate Body non-functional, we could win the case at the WTO and get no relief because the Chinese would appeal, and there would be no way of adjudicating their appeal.

Using section 301 makes the US an outlier in the global trading system, particularly since we said at the time of the Uruguay Round that we would only use it in ways consistent with our multilateral obligations, the effect of which is to encourage other nations to take similar actions against us, as is seen in the Chinese retaliation. That, in turn, contributes to the general deterioration of the rules-based trading system, which has served the US well since 1947. The advantages of section 301 are that the US makes the decision by itself – and therefore it is faster – and that it can be calibrated to address any Chinese responses. To the extent that US actions address issues that are not covered by WTO rules, we would also be on more solid legal ground.

To assess the relative merits of using the WTO, one has to break out each of the US complaints against China; some of them are more susceptible to effective WTO action than others. For example, the subsidies the Chinese intend to use to pay for Made in China 2025 are most likely violations of WTO rules, and if we act against them pursuant to US countervailing duty law, our actions would most likely be sustained in the WTO if the Chinese took us there. That is essentially what the US did on steel. The US industry brought so many dumping and subsidy cases – and won them – that China dropped from our first

or second largest source of steel imports to tenth or eleventh. That suggests that a combination of remedies might be the best approach because of the complexity of the problems that China poses.

QUESTION 2:

What other actions could be taken with our allies to further confront China?

I believe that it is more effective to deal with China through forging a coalition of countries. The Chinese don't like to be criticized by a coalition of countries, and it is more difficult to dismiss the concerns of many than it is to dismiss the concerns of one. Creating a coalition should consist of two elements:

1. Like-minded nations conveying the same message to China at the highest level at the same time. This is the pressure part.

2. Building a network of Western rule-of-law based institutions that set the rules for trade and competition to which the Chinese would have to conform if they wanted to access the markets of the coalition members. That was what TPP and TTIP were about – creating large networks with good rules on intellectual property, state-owned enterprises, and so on that the Chinese would ultimately have to adhere to if they want unfettered access to these markets.

The US should also recognize that the real competitive battleground on Made in China 2025 issues is in third countries. We are not likely to ever receive fair treatment inside China, and we can reciprocate with respect to their access to our market. We will end up competing everywhere else, and we should be focusing our efforts on building support in those other countries.

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