Transcript: Virtual Forum for Risks in the Semiconductor Manufacturing and Advanced Packaging Supply Chain

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USG Panel Members:

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Speakers:

1. GlobalFoundries, Michael Hogan, SVP AIM Business Unit
2. Intel Corporation, Tom Quillin, Senior Director for Security and Trust Policy
3. MediaTek USA Inc., W. Patrick Wilson, Corporate Vice President, Government Affairs
4. Transphorm, Primit Parikh, Founder & COO
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6. Interos, Jennifer Bisceglie, Founder & CEO
7. ClearPrism, LLC, Andrew Johnson, Managing Partner/Co-Founder
8. Deloitte, Combiz Abdolrahimi, Emerging Technology & Innovation Leader
9. Information Technology Industry Council, Alexa Lee, Sr. Manager
10. Coalition of Services Industries, Christine Bliss, President
11. IDEMIA, Brendan Peter, Vice President, Government Relations
12. Linton Crystal Technologies, Todd Barnum, Chief Operating Officer
13. Seagate Government Solutions, William Downer, Vice President, National Programs
14. Hemlock Semiconductor LLC, Philip Dembowski, Senior VP and Chief Commercial Officer
15. The MITRE Corporation, Dr. Shamik Das, Division Chief Engineer
16. National Defense Industrial Association (NDIA) Electronics Division, Dr. Michael Fritze
17. SEMI, Kimberly Ekmark, Director, Public Policy & Advocacy
18. SIA, Falan Yinug, Director, Industry Statistics and Economic Policy
19. Alliance for Automotive Innovation, John Bozzella, President & CEO
20. Motor & Equipment Manufacturers Association, Ann Wilson, Senior Vice President
21. National Association of Manufacturers, Stephanie Hall, Director of Innovation Policy
22. Association of Home Appliance Manufacturers, Kevin Messner, SVP
23. American Chemistry Council, Ed Brzytwa, Director for International Trade
24. Coalition for a Prosperous America, Jeffrey Ferry, Chief Economist

Moderator:

- Erika Maynard, Bureau of Industry and Security, U.S. Department of Commerce

Sahar Hafeez: Good afternoon, everyone. It is my pleasure and honor to welcome you to the Department of Commerce Bureau of Industry and Security Virtual Forum for Risks in the Semiconductor Manufacturing and Advanced Packaging Supply Chain. I wish we could all be together in person but unfortunately, these are the circumstances we find ourselves in. Hopefully we'll be able to do that sometime soon. My name is Sahar Hafeez and I'm a Senior Advisor at the Office of the Under Secretary in BIS. Over the past several weeks I've had the privilege of working closely on the Semiconductor and Advanced Packaging Supply Chain review, which is the subject of the Forum. The study is required by President Biden's executive order on America's Supply Chain. The executive order provides that the United States needs resilient diverse and secure supply chains to ensure our economic prosperity and national security. More resilient supply chains are secure and diverse facilitating greater domestic production, a range of supply, built-in redundancies, adequate stockpiles, safe and secure digital network, and a world-class American manufacturing base and workforce. Resilient supply chains, will revitalize and rebuild domestic manufacturing capacity maintain America's competitive edge in research and development and create well-paying jobs here in the United States. This is especially the case for the semiconductor industry, which is a major engine for U.S. economic growth and job creation. Semiconductors are essential to modern day life. They are key foundational technology for everything digital and have transformed virtually all sectors of the economy including the internet, telecommunications, transportation, and healthcare. Semiconductors are the underpinnings of the industries of the future such as advanced manufacturing or artificial intelligence and the internet of things, as well as the brains behind a myriad of consumer products from various appliance to autos. The industry is mired with serious challenges as evidenced by for examples the chips shortage we are currently facing. We are very excited to hear from you regarding the risks facing the industry and recommendations for addressing these risks and we thank you very much for your participation. With that, it is a privilege to hand this over to Assistant Secretary Matthew Borman who is a National Treasure with a wealth of knowledge and a deep sense of mission.

Matthew Borman: Thank you Sahar. And thanks to all of you who are participating particularly the speakers. Industry input is very important to us and we thought that this forum would be a good complement to the written comments we received with the comment period that ended on Monday. I wanted to just briefly touch on the process we're using to develop the report to help give you a sense of how we're going about. As you know, 100 day deadline which puts us to the beginning of June we have many internal deadlines to meet and certainly we'll use all the comments that we hear today to factor into the report as we're drafting the next version. We have here at BIS actually our defense industrial base group is taking the lead and writing the report but with significant input and collaboration from the semiconductor experts in the International Trade Administration here at Commerce as well as other parts of the Department and National Institute of Standards and Technology, Census Bureau, Economic Development Administration as well as other agencies that have a stake in the semiconductor industry. So we also will be looking forward to once we have the report done probably significant follow-up and certainly as we move into looking to implement the Chips Act once there's appropriated funds, will be I'm sure significant more interaction with the industry stakeholders. Thank you.

Moderator: [inaudible] The USG panel will ask questions of the speaker's they'll be no attendee questions during this forum. Please identify yourself and your organization when speaking and please mute your microphone when you are not speaking. Speakers will hear a bell when they reach the six minute time limit. We will allow you to wrap up for one more additional minute. And after that one minute, we will be cutting off the microphones to ensure that we keep on schedule. The chat box for this WebEx is going to be disabled. If you need technical assistance, it will be available through our conference line 888-452-5950 and the passcode is 8452104. Again 888-452-5950 passcode 8452104 if you run into any technical issues. I know there's press on the line today, they'll be no open question and answer session during this forum for press. But if you have further questions, you can contact our office of congressional and public affairs. They're available at 202-482-3064. And with that, I think we can get started with our first speaker GlobalFoundries, Michael Hogan.

Michael Hogan: Yeah, thank you. Thanks for inviting me and letting me go first. So I'm the SVP of our Automotive, Industrial and Multi-Market Division at GlobalFoundries, also known as GF. I have been in the industry for 35 years worked in nearly every aspect of the business from engineering, to sales, to P&L management, across literally every business model that the semiconductor industry operates, fab-less, fab-lite, IDM, foundry. Having seen all that, I can personally attest that these times today are unprecedented extremely difficult, but I think ironically offer the brightest possible prospects for the industry in the country. If we act now and move boldly in funding the Chips Act. So I'm going to do four things and when I introduce GlobalFoundries, I'm going to speak a little bit about why semiconductors are so important to U.S. interests and our nation's prosperity, talk a little bit about how we got here and what problem we're solving hopefully, and then just a little bit about the way forward at least in the view of GlobalFoundries. So GlobalFoundries is one of five semiconductor manufacturers of any size and the only one that actually has a truly global footprint operating in Europe, the U.S., and Southeast Asia and we happen to be the only pure play U.S. foundry meaning that we service other semiconductor companies we do not compete with them anywhere in the market. We have some experience in this notion of public and private partnership. About 12 years ago the state of New York put in a billion dollars alongside GF's four billion to create state-of-the-art facility in Upstate New York. That's created instantly 1,200 jobs and since then we've put another 15 billion dollars into that facility into that into that area and have grown to over 3,000 employees and ranging from technicians with you know, GED backgrounds all the way up to PhDs in our R&D operations. It's been an excellent return on investment and I think at the time was the largest public private partnership to support semiconductor manufacturing and innovation in the country.

We do service the U.S. Department of Defense. Our Fabs are the most secure in the industry. We're trusted ITAR compliant and a supplier to DOD and fully compliant with all of Commerce's export compliance programs. Our chips are focused on some of the largest most pervasive segments in the industry. We produce chips that cover over 70% of the manufacturing service or foundry market by dollar and probably more than 90% of the non-memory demand measured by quantity of wafers shipped. Moving on, why are semiconductors so important to the U.S. and to our prosperity? Chips are everywhere from smartphones to auto to the technology in our schools and hospitals and as the intro said we simply in our modern society can't survive without them. They change how we work and live and they're becoming ever more pervasive and frankly one of humankind's most vital resources. But they are incredibly complicated and expensive to manufacture. A chip the size of your fingernail can

have billions of electrical switches and precise patterns and they must be produced in the trillions to sustain our way of living. So, how did we get here? And what's the problem to be solved and also focus a little bit more on automotive since that's part of the agenda for the conference. I mentioned earlier there's only five companies of any size that provide manufacturing services for the entire global supply of semiconductors. There's only one in the U.S. and three are located in Greater China. Taiwan alone controls more than 60% of the world's chip output and we should all care about who these companies are, where they're located, what they produce, and you don't have to go any further than considering the recent chip shortages in automotive and how much impact they've had in just one year. So how did we get here? The pandemic was a wake-up call, you know, we've always been sustained by technology, but in 2020 in the covid-19 pandemic, we really experienced about a 10-year leap forward in a single year.

The IOT market, the internet of things, alone is expected to expand from a hundred fifty billion dollars in 2019 to $243 in 2021. That's more than 60%. And there is simply no going back. In the near future the idea of having 30-50 connected smart devices per person will be commonplace. There's eight billion plus or minus folks on the planet if you do the math it’s enormous and it's unprecedented. At the same time the electronic content in a vehicle is approaching 50% of the car's value by 2030. These cars will run literally millions of lines of software per vehicle. They'll be ever more powered by a battery instead of a gas-powered engine. They'll be ever more capable and autonomous and all that software all of that power management, all of that sensing and communications rests on semiconductor technology.

Now the supply shortages for automotive are almost entirely based on manufacturing technologies that have been in production for 5, 10, 15, or even 20 plus years. And these technologies compete with consumer products for supply at multiple levels in the supply chain. So the vital nature of semis to auto is now well understood and we will absolutely see the supply chain embrace a different level of intimacy with semiconductor manufacturers from supply all the way to fundamental involvement in R&D. But, we need to build more and we should do it here in the U.S. where our national manufacturing share of the worldwide market has slipped to 12% at a time when other nations are putting on large investments as a matter of industrial policy. So as far as the way forward, semiconductors are the most vital resources on the planet, it's time to recognize our dependence and collectively invest. Economic progress, national security, our health and safety hang in the balance. Shortages affect more than just the availability of product and higher prices, chips power internet connectivity, utility grids, healthcare technology, and much much more. As I stated, these are vital resources and nations, especially and specifically the U.S. should seek supply independence by [inaudible] our manufacturing capabilities within our own borders. It matters where these chips are manufactured tested and package because it directly reads on the reliability and security of supply. The race for faster, smaller chips is only a piece of the story. GF is focused on the chips that are designed for high growth markets such as artificial intelligence, IOT, 5G and wireless connectivity, automotive, and industrial. These are the most pervasive chips, so we have to solve for the total volume not just for the high-end. We will continue to produce a broad range of these chips for society. And if we make the investments a more level playing field versus other nations that have been industrious policies to do so, we will come through this in a much better place. So it's time to put a sharper focus on semi manufacturing as a vital international resource and to learn from these recent events. Thank you very much.

Moderator: Thank you, Mr. Hogan. Next we have Tom Quillin with Intel Corp.

Tom Quillin: Hi, Erika, just quick sound check. You can hear me well.

Moderator: Yes, thank you.

Tom Quillin: Okay. Thank you. Hi, my name is Tom Quillin. I'm a Senior Director with Intel's Government Markets and Trade Team. Intel Corporation appreciates the opportunity to participate in this Virtual Forum supporting the Department of Commerce's efforts to identifying risks in the semiconductor manufacturing and advanced packaging supply chains. Semiconductor supply chains are geographically diverse and complex. Generally the global nature of supply chains provides U.S. manufacturers valuable flexibility and mitigating risks to chip supplies. However, today the industry faces a crossroads and the administration's prioritization of this matters is well-placed. I will briefly introduce Intel then highlights some of the challenges facing the semiconductor industry and offer some recommendations.

Intel is the only U.S. Semiconductor manufacturer that designs and manufactures advanced microprocessors on United States soil. Despite the cost disadvantage Intel faces in growing its domestic operations, the majority of the company's R&D and manufacturing occurs in the United States. The revenue Intel receives from sales overseas is used to fuel investments here in the United States, including up to 10 billion dollars in R&D spending in the U.S. every year.

Today Intel has more than 53,000 employees and high-tech jobs in the U.S. with most being located at our large manufacturing sites in Arizona, in Oregon where I'm calling from, and in New Mexico. Intel sees America at a critical inflection point. How the U.S. government invest in the semiconductor industry likely will determine the future of domestic technology innovation and U.S. Global Leadership. Semiconductors powered the internet. They're the building blocks of the digital economy and provide the foundation for all critical technologies from artificial intelligence to 5G to autonomous vehicles. Our country's leadership in designing and developing semiconductors is a major reason the U.S. has the world's largest economy, most advanced technologies, and strongest military.

Today's semiconductors remain one of America's largest exports yet the U.S. share of semiconductor manufacturing has eroded from 37% several decades ago to just 12% today. Other critical parts of the semiconductor supply chain for instance, advanced packaging, have eroded a lot more. Primary causes of this erosion include a 25 to 40 percent cost disadvantage to U.S. based manufacturers compared to their heavily subsidized competitors in Asia and also the investment by foreign countries of tens of billions of dollars into building new state-of-the-art semiconductor manufacturing packaging and assembly test capabilities. As President Biden said in introducing the administration's 100 day supply chain assessments, the United States is the birthplace of this technology and has always been a leader in semiconductor development. However over the years we have under invested in production hurting our innovative edge while other countries have learned from our example and increase their investments in the industry. Similarly, the Pentagon's 2020 industrial capabilities report highlights growing concerns about depending on foreign semiconductor suppliers. The report notes other countries have invested billions to fund the construction of new Fabs. The hard truth, the report argues, is that U.S. chip production will decline to a point of irrelevance if Washington does not start investing in new production facilities. We will have few new Fabs. We will have frightening vulnerability to foreign cut-

offs whose impact would make our covid related shortages look miniscule. This is not a healthy situation.

Moreover, although Intel invented the microprocessor and led in semiconductor manufacturing for more than 40 years, it has recently fallen behind by a technology node. We are investing billions to regain the lead but in the meantime all logic capacity less than 10 Nanometers is currently located in Asia, a dangerous situation in terms of securing the substantial and increasing needs of the U.S. economy for advanced logic and the computing power it generates.

Some recommendations. On the Chips Act, the U.S. must lead in R&D, fabrication, and packaging. Success in these three stages of semiconductor manufacturing will drive the greatest momentum for new innovation for generation of know-how, for workforce and education development, and advanced manufacturing methods. The Chips Act appropriately authorizes federal grants for all these types of semiconductor activities. As noted by the Biden Administration semiconductors will play a foundational role in the next big wave of computing, enabling new devices and technology that will increase the connectivity of people, places, and things around the world. To meet this demand semiconductor manufacturing capacity was increased by more than fifty percent and that is why it is critical to promptly and fully fund the Chips Act with 50 billion dollars as called for in President Biden's American jobs plan. On workforce, high-skilled immigration is a key component of the ongoing ability of the United States to obtain and retain the talent necessary for America and American Enterprises to continue to innovate and create jobs in the U.S. Intel supports eliminating the Green Card backlog through recapture of unused Green Cards and exempting advanced stem degree graduates of U.S. universities from Green Card caps. These two reforms would have the greatest economic and workforce impact. On supply chain assurance, the administration should develop policies that promote adoption of best practices for business continuity planning and promoting increased supply chain transparency, for example, the administration should incentivize suppliers of ICT products to the U.S. government that share information about security practices and about upstream suppliers who contribute to develop finished products.

And on export controls, Intel recommends generally avoiding the imposition of unilateral export controls as these restrictions place undue hardship on U.S. semiconductor companies, especially when similar items are available in foreign markets. The foreign availability of products and technology typically leads to the substitution of U.S.-origin products and technology for comparable non-U.S. origin items that are not similarly controlled.

Intel thanks you for the opportunity to speak today, and we look forward to continuing the conversation on this important matter over the months ahead. Thank you Erika, back to you.

Moderator: Thank you. Mr, Quillin. Next we have Mr. Patrick Wilson with MediaTek.

Patrick Wilson: I need a quick sound check. Good afternoon. This is Patrick Wilson. I'm the Vice President of Government Affairs for MediaTek Incorporated. I want to start by thanking my good friend Matt Borman and his team at BIS for hosting this forum today and then it's with great humility and respect that I stand in front of this guest panel. I looked at the list of those who are in attendance today and the combined experience in the export controls and semiconductor sector is truly humbling. And I'm so glad that my colleagues at the department will get the benefit of such a great collection of voices. As I said, I

am with MediaTek and we are a fabless semiconductor company and what I hope to do today in my remarks is really threefold goals. The first one is to explain how foreign headquartered companies or outside investors through foreign direct investment in the United States contribute mightily to the health, success, and the innovation ecosystem that exists here in the United States. This is an often overlooked component and I'm so thrilled to be able to sit alongside really legends in the semiconductor industry, companies like Intel and Texas Instruments, and others and see the role that foreign headquarter companies particularly fabless semiconductor companies have had to contribute to America's innovation success.

So my second issue that I hope to call attention to here today, in addition to the role of foreign headquartered companies, is to provide a rubric if you will to the government because I know as you prepare these recommendations for the president you're looking at the tools in the toolbox both of government agencies and departments all across the government, and also what legislation should be championed to get the right result to secure America's supply chain. I would like to humbly suggest from my more than eight years working in the semiconductor industry at the Semiconductor Industry Association, often industry leaders like Craig Barrett from Intel and others would explain to senior leaders that it's really a question about here versus there. Every single policy tool that government contemplates has to be run through this aggressive rubric. Will what we produce today in this regulatory environment, will it make it more or less likely that innovation itself will occur inside the friendly bounds of the family of nations who share the same values, the same commitment to Human Rights and individual liberty, but mostly about transparency, collaboration, research based on innovation. And if you look at every single one of these tools that's under contemplation, they would all kind of get a rating right on whether it makes it more likely to be here versus there and where Intel ended up I'll pick up again and say one of our concerns is that through unilateral U.S. action we even - well intentioned right to protect U.S. National Security interests - we often add weight to the side of the equation on there. They want to get innovation happening outside of the reach of these excessive regulations and that is against U.S. interest. And that's the second area that I want to talk about a bit today after this here versus there debate is the question of what about the unconventional risk to the supply chain and most of them fall into the category of what happens if innovation happens somewhere else and that's an important area for government to consider again.

So lastly the third area I'd like to draw your attention to is how do we get the incentives right, the mix of policy recommendations, economic choices, and other policies which encourage innovation to happen inside the boundaries of the United States or at the very least within the confines of friendly allied nations. And I think that all of those things taken together are get to the heart of what the president has challenged all of us to do, which is to secure the supply chain. So to go back to my first point that I was predicting is the here versus there debate. I think that again I would commend to the government a rating system effectively for any proposal about whether we'll make it look more or less likely that innovation will happen in the United States. As a foreign policy maker myself, it was always tempting right to try and craft really tough restrictions on where technologies can go or who can participate in them. But that really defies the overall culture of innovation that we see across the world. Any number of U.S. Headquartered companies if you look in their laboratories, you see the great diversity of employees from every country all around the world and how they work together seamlessly with collaboration tools like the one we're using today and they solve problems for customers. That

collaboration is a unique Special Sauce that the United States has led the world we're the best place in the world for open communication collaboration and we've been traditionally the most welcoming of immigrants, particularly high-skilled immigrants and many of the companies that are on this call that also populate the directory of Silicon Valley they count those foreign innovators as part of their foundation story. And that also has to be a question in the here or there. Do we have the right policies that are incentivizing the most innovation to occur here?

So I've highlighted a couple of those areas what I'd like to move to second which is my real question about why MediaTek or why the fabless companies headquartered outside the United States, why do they even care about fab capacity or if they just neutral where ever the lowest price provider is that's where they need to be and the answer is no because companies like MediaTek, one of I think we're now the fourth largest fabless semiconductor company in the world. We depend on Fab capacity everywhere to serve our interests but something that the government should pay special attention to and I'll wrap up with this, is that pure play foundries like GlobalFoundries like TSMC like other partners, they make our business model possible and what that has done is reduce the barriers to entry for players to get into the semiconductor industry because you don't have to build and constantly update a fab and that's an economic principle that I would really commend to the BIS and the Commerce Department to think about how this foundry capacity which even in the United States is mostly foreign financed, whether it's Qatari or our Korean allies or Taiwanese. A lot of that foundry capacity is capitalized outside the United States, that foreign direct investment is important. So I'll just conclude my time here by saying just as my colleagues did if we seek to aggressively to produce unilateral controls, we may have the unintended consequence of driving innovation outside the United States and ultimately undermining our supply chain security. Thank you very much for your time today.

Moderator: Thank you, Mr. Wilson. Next we have Mr. Parikh with Transphorm.

Primit Parikh: Hi, good afternoon. Thank you. Some of the camera is not working, but you can you hear me everybody.

Moderator: Yes, thank you.

Primit Parikh: Great. Thanks for the opportunity. I'm Primit Parikh, President and Co-founder of Transphorm, who is a pioneer and leading supplier of gallium nitride power conversion devices in the world and I hope to share with the group the importance of gallium nitride which has emerged as a leading new semiconductor platform over the last two decades for several areas. Transphorm is focused in gallium nitride for electrical energy conversion power conversion ranging from applications such as 5G, power supplies for data center cloud computing, telecom, industrial power, [inaudible] to most importantly automotive and electric vehicles converters and inverters and we are also provider of gallium nitride wafer materials for the RF industry communications and we have a history of working with Department of Defense and the U.S. Navy already. So Transphorm is the public company, we are a small company certainly by no means an Intel or a GF, marquee leaders in the field but we are a public company and only pure play public company in this important area of gallium nitride. So what is gallium nitride its [inaudible] semiconductor material. Like I said, it's been around in the areas of LED lighting and RF and microwave industry and now being rapidly adopted for power conversion with the demonstrative ability to be disruptive over silicon power devices in both power and RF applications

allowing powerful smaller more efficient semiconductors that can operate at high voltages and much faster speed than traditional silicon. So the latest result is staggering energy efficiency saving 20, 30, 50 percent electrical energy loss in power conversion. Long term, this can be saving several terawatt-hours tens hundreds of terawatt-hours can be saved with widespread adoption of gallium nitride. So like any semiconductor the manufacturing portion is critical the design the innovation and Transphorm is vertically integrated we aim to control most important aspects of the supply chain of gallium nitride from the core epi wafer, the starting material which is fundamental and critical the most fundamental thing I would like to stress, and then subsequently GAN device technology wafer fabrication at this point six inch is working in future it could migrate to 8 inch packages which are standard power packages and very importantly quality reliability and testing which is also a critical area. So while not everything necessarily is in the U.S. there's certainly a strong manufacturing need in the U.S. for the fundamental GAN materials, which is the core at this platform, which is the starting material of gallium nitride and that in turn is made on other a variety of substrate types. So gallium nitride materials manufacturing happens in what is called reactors and mostly epi wafer reactors where along with its full characterization facilities and infrastructure that go with it, and these are highly proprietary processes, depending on what application the gallium nitride wafers one is manufacturing for, in our case the power devices and RF devices. And the challenges are how do you have the IP which Transphorm certainly has, we are the leading IP holder in the world for gallium nitride in fact, but how do you convert that to manufacturing scaling large area defect-free highly uniform semiconductor materials that can be then processed at wafer Fabs foundries for delivering high quality product.

And then associate supply chain. It is very important to have suitable substrates, especially for certain newer flavors of gallium nitride materials packaging houses, especially modules the power modules that incorporate multiple devices and intelligent packaging intelligent components called IPM intelligent modules that are competitive with silicon-based device manufacturing and open source available for a variety of device makers such as ourselves and others. Then sufficient firepower and resources and design and development of application reference designs that showcase the industry how to use the gallium nitride effectively because it is the fundamental new material different from silicon and coal to the innovation to how to use it. Investment in test infrastructure quality and reliability and long term performance assessments and then importantly wafer Fab perhaps including partnership with a close partner countries, like the previous speaker mentioned, close partner countries of USA, Japan for example where infrastructure may already exist as well as U.S. manufacturing wafer Fab infrastructure. So our goal is for the U.S. and Transphorm to be an innovator, a leading pioneer in gallium nitride, this new semiconductor material. Several countries are making strong investment China being a key example in this area of wide bandgap semiconductor material in gallium nitride already, and we hope to partner with the government, with the DoD, with this esteem group in GAN power conversion and GAN materials for both RF and power application with a strong U.S. manufacturing presence in the fundamental gallium nitride wafer materials manufacturing capability. Thank you so much. I'll conclude with that.

Moderator: Thank you so much. Next we have Eva Hampl with Dell Technologies.

Eva Hampl: So I am the Director for International Government Affairs at Dell Technologies. I appreciate the opportunity to participate in this discussion and provide Dell’s perspective on the issue of the

Semiconductor Supply Chain. As others have already stated, this is a critical issue and it is very timely for BIS to conduct this investigation.

A little bit about Dell Technologies, we're a multinational technology company that provides the essential infrastructure for organizations to build their digital future, transform IT, and protect their most important asset information. Our products and solutions require a variety of semiconductors or chips as they're often referred to the continued access to supply is a priority for us. My comments are going to focus on the importance of the semiconductors to the entire economy, the IT industry in particular, and what we need to do as a country to secure sufficient future supply. As we heard in the introductory comments semiconductors are a foundational technology and are necessary for the current and future American economy. Many industries are increasingly in need of chips including ours. The IT industry in particular has been vital to pandemic recovery with the increased demand of remote technology services in light of the recent shift to remotely learning, working, and healthcare. There's a significant need across the country for the essential products that the IT industry makes to enable Americans to live their lives, do their jobs, and educate their families from home. Demand for chips from IT manufacturers is therefore at an all-time high and we don't expect that to change anytime soon. In fact, we continue to work hard to help bridge the digital divide. The reality of the American economy is that not everyone has the necessary tools to be able to effectively work or learn from home at this point despite the nation entering the second year of the pandemic. In addition to providing devices, Dell has invested in solving the Broadband deficiencies that exists throughout communities and are looking to partner with the administration in its efforts to address the digital divide. The impact on education continues as the vast majority of schools remain partly or completely closed requiring students to take classes online due to the ongoing pandemic. Semiconductors are necessary components of devices and Broadband which are key components to enable the remote workforce and students. They also play an important role in remote healthcare and advanced healthcare treatment, including helping underserved and vulnerable communities. In particular, telehealth has been vital during the covid-19 crisis where existing issues such as treating immobile or impaired patients in remote location have been exacerbated. Given the continuously increasing need for semiconductors in many industries, it is vital to address the current Global Supply shortage. Unfortunately, there are no feasible solutions in the short term even for existing semiconductor fabrication plants or Fabs as has been talked about, it takes several months to ramp up production.

Looking to the long-term, the need for semiconductors will only increase in the future. Significant government investment into the growth of the chip manufacturing industry is going to be necessary. Building new Fabs is almost prohibitively expensive without significant investment. Tangible long-term solution that will help ensure a domestic, stable, and reliable supply of chips is fully funding the Chips Act that other speakers have already discussed. This will allow us to remain globally competitive in the future and must be a priority. The nation's economic growth and national security rely on semiconductor production to stay ahead of global competitors, which will have a major impact in the global race to deploy new innovative technologies, including 5G, AI and Quantum Computing. Given these global implication, any evaluation of the semiconductor manufacturing and advanced packaging supply chain must consider the global landscape. When looking to invest in our future when it comes to securing the supply chain, the Chips Act must be funded without any carve-outs allowing innovative to drive supply and demand. Having the government pick winners and losers will exacerbate the digital

divide at a time when the government should be looking for ways to help those most impacted by the pandemic and economic slowdown, including rural and underserved American schoolchildren. As general economic policy, the government should not interfere in market dynamics on behalf of an individual industry since the market and the innovative tech space always moves at a faster pace than government action.

Finally as we look to building resilient supply chains, it is important for the government's findings as a result of the investigation to reflect the importance of having sophisticated supply chains that can withstand inevitable disruption. This includes incentivizing companies to plan ahead and appropriately diversify their supply chain in order to be ready for inevitable market insecurities.

This is a critical issue of great importance to Dell technologies. So thank you for hosting this forum today. We also submitted written comments, and we look forward to the continuing dialogue. Thank you.

Moderator: Thank you. Our next speaker will be Jennifer Bisceglie with Interos.

Jennifer Bisceglie: Good afternoon. Thank you for having me. I appreciate the opportunity to participate in today's event. As Erika mentioned, my name is Jennifer Bisceglie, CEO and Founder of Interos; we provide the U.S. federal government and our commercial customers an artificial intelligence platform that continually maps, monitors, and models the global supply chain, mapping to the nth tier for our customers and across multiple risks, including financial, operational, governance, geographic, and cyber.

Our customers care about everything from cyber breaches in their sub-tier suppliers such as SolarWinds, to the financial instability and the need for stimulus funding of the sub-tiers of suppliers after Covid, to the over-reliance of various products and parts only being produced in one part of the world, and meeting ways to identify and invest in alternative sources, which brings us to today. I'll briefly speak to the semiconductor topic is today, and then quickly move on to recommendations based on our 16 years of supporting the U.S. federal government supply chain risk posture.

You've already heard a lot of the ideas that we had earlier today, so I don't feel the need to kind of revisit everything and you can thank me later. So over the last 14 months, as we all know, the global supply chains, including the semiconductor supply chain, is seeing massive disruptions. The frequency and severity of the semiconductor supply chain shocks can no longer be considered entirely unpredictable. We've actually heard the concept of the Black Swan being dead because these things can be anticipated and take action on. The semiconductor supply chain specifically is very complex. The production of a single computer chip often recovers more than a thousand steps passing through international borders over 70 times. The supply of semiconductors to satisfy consumer demand is only a sliver of the true threat failure to address these risks and develop alternative sources of supply that will also impact downstream abilities such as utilities, aerospace and defense, 5G development, and so on.

To prevent similarly outsized impacts from occurring again, we strongly recommend that the federal government, and the commercial organizations that support them, embrace operational resilience as a core business and mission priority, which is where I'll be spending a bit of time talking today. Maintaining domestic manufacturing capabilities is essential to ensure the U.S. semiconductor industry has a highly resilient, geographically diversified supply chain. President Biden said as much in his recent

executive order, “the supply of the United States needs a resilient, diverse, and secure supply chain to secure economic prosperity and national security.” Here at Interos, we couldn't agree more with the policy objectives set forth in the Executive Order 14017 and strongly recommend that the government and industry continue to find ways to work together to adopt an operational resilient posture to ensure the steady supply of goods, foster global competitiveness, and maintain national security.

So what is operational resilience? It's the ability of an organization to continue to provide their products or service in the face of adverse market or supply chain events or shocks, and this is a little bit different than simply the term around “supply chain integrity” or “security” or “supply chain risk.” Operationally resilient organizations do three things really well. They continuously monitor for potential risks and proactively make adjustments to minimize and potentially prevent disruption versus just doing singular vendor risk assessments or “deep dives,” as we hear them called. They quickly identify disruptive events around the world to evaluate potential exposures to the things that they deem critical, find alternatives, and respond fast. And operationally resilient organizations anticipate, model, and plan for possible future scenarios, building the organizational skills to address and respond to these challenges, including advanced identification of alternative sources as needed. So just to finalize and get to the recommendations very quickly - as we see it, the next step is truly operational. I see the institutionalizing operational resilience. This, to us, comes in two different forms, one is organizational and one is technological, and I'll go through those recommendations very briefly. For organizational operational resilience, there's three areas that we've consistently talked about here at Interos. I've personally testified in front of Congress multiple times on this topic. There needs to be three things: a shift in behavior of leadership, and you're seeing that with the executive order; to prioritize supply chain risk versus pushes down into the organization. Provide the required funding, we've looked at the COVID relief bill that had ten billion dollars focused on this and then it got pulled. We're looking at the Department of Defense, trying to stand up. So a very forward-looking approach on “collect once and share,” which I'll touch on here in a second, but we have to give it the appropriate funding. It's been missing over the years and what it's done is it’s provided the opportunity for gaps both in supplies, such as the semiconductor topic we are here to talk about today, as well as just overall economic competitiveness. We're not leaning forward into it. And then the last - and this is really one of the things that I am seeing change, and I’m very heartened by, across the government - is managing risk as truly an organizational wide job. It's not the domain of one person or one team. So where it's not happening, we see current approaches that they're siloed within agencies and then teams within those agencies. It's a very expensive approach. It's a very redundant approach. And again, it creates those gap areas that risks can easily slip through. For a technology forward-leaning approach into operational resilience, we also look at three things. This is all about tools and technology. Those tools need to map suppliers instantaneously and automatically globally and they really need to monitor. We have to get out of applying manual resources to this, out of surveys, and one-and-done annual events. This is an ongoing problem. It's a business problem to be solved and things happen around the world every single day that are outside of our control that either we need to preempt disruption or get ahead of it and take advantage of opportunity.

So our last recommendation, I mentioned a moment ago, the government to prioritize implementation of our government-wide approach to operational resilience and this idea of “collect once and share.” Again - it gets rid of the wasted cost, the redundancy, and just makes the whole of government

approach that much stronger. Thank you for having me today, we will submit written comment, and I remain available for any questions and look forward to this continued dialogue. Erika back to you and thank you.

Moderator: Thank you so much. Next we have Mr. Andrew Johnson with ClearPrism.

Andrew Johnson: Yes, thank you Erika, you can hear me, right?

Moderator: Yes.

Andrew Johnson: Wonderful. My name is Andrew Johnson. I am the Director of Innovation at ClearPrism and I'm honored to be speaking with this esteemed group today. ClearPrism, two seconds on us. We're a group of about 40 data scientist, PhD quants, and business strategists/futurists. Most of our work lies in both the private and public sectors identifying bad actors and combating criminal financing, illegal trade, all the stuff that we don't want to find in the world that people try to hide. And we are taking some of these concepts to help identify, predict, map and quantify events. And then the correlating risks and technologies to the supply chain, specifically around the semiconductor space, along with also looking at the T2, T3, Tn partner networks and any portfolios that come along with that.

The angle in which we're looking at this or the lens we're looking at this through is through algorithms and a set of very rich taxonomies and proprietary AI. So our esteemed colleagues at Interos know exactly what we're talking about. Our interest in this work is really looking at the challenges and the impacts of the ripple effects on both Black Swan and unseen events, specifically in the semiconductor space, and subsequently identifying the faint signals within those events. So the common threads here are faint signals. How do we find things to know what's going on? So the objective of what we are trying to do here is to demonstrate that such data-driven insights can revolve in a more resilient and adaptive supply chain specifically in the critical parts of our overall value chain regardless of the backcast to it, or the likelihood of these events happening or the Black Swan type of events and the unforeseen ripple effects throughout the partner network and the value chain for things like COVID or the Suez Canal blockage. Beyond the current phase of what we're looking at, we are trying to enable an algorithmic and predictive events sensing platform to identify those types of risks and the probabilistic economic and workforce implications on the key national security objectives and critical factors the U.S. economy contributes to the executive order of America's supply chains.

So what this all kind of means and what we're looking for is meeting the subjective means teasing apart and breaking this into a couple different technical challenges and elements that we need to resolve to create sort of a pragmatic approach. One is amplifying the faint signals of events that matter. Two is clarifying the impacts and the specific capabilities or parts of the activities that make up the critical piece in the supply chain. Three would be quantifying those risk exposures of the impacts both of the supply chain and more importantly the T2 to TN ripple effect through partner networks and tertiary industries. And then four is modeling the downstream operational workforce and financial implications, which leads back to some of the operational resiliency that Interos was just alluding to. So let's quick talk about the capabilities and then I'll wrap up. From a capability standpoint, we believe the imperative is how do we apply AI to gain insights into the impact of these unforeseen events amongst the top 20% of capabilities or assets that drive a majority of the economic value within an organization and thus throughout the value chain? As the market conditions and technologies evolve, this ongoing relevance

of that top 20% of things that companies do good and the “secret sauce” of companies - that's always evolving and decaying and changing and we're exploring how supply chain dependencies on these specific capabilities can be assessed, and visualized through input and output linkages.

Such linkages will vary across time and across products and technologies and that's kind of what we need. So pragmatically this means that the insight into what makes up these changes provides foresight into how the ripple effects will occur within the supply chain of a given industry or company or across the geopolitical divides. So stories around COVID and Suez Canal and disruptions they’re rampant, right? So, why are we talking about this? Why do we feel like we want to add something to this discussion? Because if nothing else, if COVID and Suez disruptions focused everyone's attention on what are the implications of a dramatic impact, then we need to study the critical capabilities -- not just things like skews or particular markets -- to protect these critical supply chains. So the objective here is really simple. Let's point out and stress test what are the decisions policymakers and company executives are making to consider what the new capabilities they need are so that they don't get surprised again versus simply looking at economic and skew or product line based type analyses. So I'll just very quickly wrap up with this kind of a clear point here. Ripple effects exist across partners, industries, and geographies. The degree to which they may occur, however, has three different considerations.

It's the extent of the dependency. So what companies or industries or supply chains, and what degree do they relate to the supplier or customer of the from-companies from-industries or from-locations? The second is the degree of impact. So the particular companies that may source from only a few industries, but those other industries have required capabilities and in turn may source from multiple others. So this creates this exposure of the company which in focus if a shock impacts the tier 2, it's going to ripple through to the Tier 3, Tier 4, etc. to the degree in which any of these particular shocks may trigger the ripple effect. For example, a heavy rain storm knocked out power in particular location, let's say a data center, maybe one of your partners is going to have a likelihood of the event having significant impact on your supply chain or the revenue, etc. So wrapping up ClearPrism is looking forward to partnering with BIS but also with like-minded partners here on the call and exploring how some AI will potentially bolster the sustainability of the semiconductor supply chain. So with that we thank you very much for your time and have a great day.

Moderator: Thank you, Mr. Johnson. Next we have Mr. Abdolrahimi with Deloitte.

Combiz Abdolrahimi: Thank you, Erika. Can you hear me okay?

Moderator: Yes.

Combiz Abdolrahimi: Awesome. Well, hello. Hi Sahar, it's great to see you. Thanks for sharing this opportunity with me. Hello everyone. My name is Combiz Abdolrahimi with Deloitte. For the past 15 years, I've been working at the intersection of National Security Technology Innovation in the law since I started my career at the State department as an intern and later as an innovator and National Security lawyer. I've had the privilege to serve at State, the White House, Senate and Treasury.

I've also had the great honor to serve on the Department of Commerce’s Trade Finance Advisory Council and I want to commend Paul Thanos and Yuki Fujiyama and the ITA leadership for spearheading this important work. At Deloitte, I cover emerging technology and innovation. As part of my job, I work with

public and private sector organization helping them to innovate, grow, strategize, design and implement data driven solutions with emerging technologies, including AI, 5G, edge and blockchain.

I'm deeply honored to speak on this topic. I want to especially thank Secretary Raimondo for her leadership on this critical issue. I mean it's refreshing to see real leadership return to Commerce only 36 days into the job and she's accomplished so much already and inspiring so many of us to work harder towards helping our workers and businesses during this pandemic. Solving the semiconductor shortage and building better, stronger, and resilient semiconductor supply chains is no easy task, but it's necessary if you want to safeguard our future. You know, you've heard today how semis arguably represent the world's most important industries as they are foundation for many of the products and services we use every day. They power our cars, laptops, planes, our infrastructure, our electronics, our hospitals, and data centers. They help us combat climate change with renewables and smart energy grids. We need semis in order to retain our military edge, and demand for these chips has surged and will only continue to do so in the endless age of AI and this digital era.

Yet, the pandemic and the geopolitical challenges have underscored the fragility of our supply chains and the importance of strengthening or semi ecosystem. While onshoring the world's most complex supply chain is just not feasible, we can and should rebalance our supply chains to make them more resilient. I believe that any plan to address these challenges should consider the following:

First, it's clear that we need a level playing field and create incentives to spur construction of domestic semiconductor manufacturing facilities. Every other country that has semiconductor manufacturing offers major government incentives, including grants and tax credits; so should we. I believe that the federal government should ramp up investments in semi R&D. This will create thousands of new great paying jobs right here in the U.S. Second, I believe our government should play a greater role in standard setting and get more involved in organizations - global organizations - that set standards and principles, particularly for semis and new technologies, to ensure they're trustworthy development and use. I believe that the government should monitor exports of advanced chips that could underpin dangerous or human rights violating applications. Third, I believe that the government should adopt policies to further develop and attract talent in STEM fields and encourage diversity. The federal government could sponsor centers of excellence at schools that can offer students opportunities to experiment, to learn, and build in this emerging field. Fourth, I believe that the government should do more to leverage data to identify and mitigate supply chain risks. Increased use of automation, AI, cognitive risk sensing, data analytics, and blockchain should be encouraged by government and industry alike to promote rapid processing and sharing of information across supply chains. The government could create a government industry academic center of excellence for cutting-edge R&D in semis. Lastly, I believe the government should monitor and evaluate the integrity concerns associated with semis, and explore solutions for establishing supply chain integrity. For example, lack of traceability of components can trigger vulnerabilities. Counterfeit components can compromise critical infrastructure. Blockchain or distributed logistic technology for component traceability and counterfeit identification could offer a solution to this challenge. Yes getting this right won't be easy, but for the country that invented the transistor, that invented the internet, and that sent the first person to the moon, it's not impossible. Thank you.

Moderator: Thank you. We now are going to move on to our USG panel questions. The USG panel will be asking questions of our first eight speakers. If you are one of those eight speakers and would like to answer, please use the raise hand function and we will call on you to unmute and answer. I'd like to hand it over to the USG panel for questions.

Monica Gorman: Thanks Erika. Hi everyone. My name is Monica Gorman. I'm the Deputy Assistant Secretary for Manufacturing within the International Trade Administration. My question to the presenters:

Many of you have urged government incentives to strengthen domestic semiconductor manufacturing. So, what priorities should the federal government consider in designing this incentive program? For example, should priority be placed on leading versus trailing edge technology, should priorities be placed on incentives being available for companies further up the supply chain such as equipment manufacturers, wafer manufacturers, or gas and chemical companies? I would be interested to hear your views.

And I'm going to hand it to my colleague Michele for a second question that I think we'll pose to the first [inaudible]. Michele?

Michele Schimpp: Thank you very much, Monica. Yes. Thanks everyone. I'm Michele Schimpp. I'm the Acting Associate Administrator for International Trade with the Small Business Administration. My questions for businesses, granted, recognizing that the majority of U.S. firms in the semiconductor industry are small with under 500 employees. I'd be curious to know if there are distinct risks and challenges faced by small businesses in this industry in contrast to the larger firm.

Moderator: So first, we'll go to Patrick Wilson.

Patrick Wilson: Hi, Patrick again. And Monica, welcome, delighted to have you at the Commerce Department speaking on behalf of manufacturing. I worked very closely in that office during my time on the fifth floor. So I'm delighted to have your question. I will provide some advice. I will preface it by saying this is not the view of MediaTek. This is more in response to your question about how to prioritize incentives. One of the things that I would commend to you is the idea of creating a first do-no-harm, or at least a lock-up vulnerable fab capacity that is on the bubble. I can think of some examples, like if you just pick a state randomly and look and see how many older Fabs still exist in that state. So you pick Florida, Pennsylvania, for instance, states that don't have the leading edge anymore. Your question should be what would be most helpful to extend the life of existing Fabs, right? And we certainly did this in the previous administration and looking at those and thought what could you do, if a Fab is nearing the end of its useful life, to encourage that Fab owner to retrofit or add new equipment or find new customers, etc.? And so that "don't lose what we have" is important as well as obviously the big victories like luring foreign direct investment like from TSMC and the incredible announcement from Intel. Those are the big level moves that really matter, but preserving the existing capacity, I think that is an area to concentrate.

Moderator: Thank you. Next we'll go to Tom Quillin.

Tom Quillin: Thank you Erika. On the question of priorities. Want to be really clear the SIA and BCG recently released some study data that showed that as of today, none of the below 10 nanometer

capacity is in the U.S. We should look at prioritizing the leading edge as that will be where competition comes to a head and it is critical for the U.S. to maintain its leadership there and to regain its leadership and maintain it.

Moderator: Thank you. Next we'll go to Michael Hogan.

Michael Hogan: Yeah, not to be too contrarian but on the priorities, I think you also have to look at the breadth of which the investment benefits, you know complete industries. The leading edge is an important capability, but that's not what's going into all your cars today. That's not what's driving your IOT devices, necessarily. It's not what takes pictures from your phone or plays audio from your phone or does your contactless payment, so I think you need to be more even keeled there. And then as far as small businesses, I think the number one vulnerability is competing for capacity. It is a very hard job as a small semiconductor startup, and I run two of them. So it's really awful to be a small purchaser when you've got, you know, the deck stacked against you from bigger customers that can drive more volume and make more compelling future commits. So solving that problem I think could be part of the solution.

Moderator: Thank you, and lastly, Mr. Parikh.

Primit Parikh: Thanks, Erika. So from a small business perspective, right? The manufacturing is so important and we have made it a focus to be a manufacturer of gallium nitride materials and power conversion devices. But also it's very important that the investment that it makes and it takes to do manufacturing, it's a fine balance between the small business to have the core IP, the core vertical integration and manufacturing capability which we have right here in Goleta, California.

But on the other hand struggle with the capital investments required to support such a thing. So it's a unique challenge for small businesses focused in this specialty semiconductors, like gallium nitride, which are very very important in those areas ranging from automotive to IT to be better supported by appropriate government investment. And really appreciate the raising the question specifically for small businesses.

Moderator: Thank you so much.

Primit Parikh: Thank you.

Moderator: We're going to move on to group two now. Information Technology Industry Council, Alexa Lee.

Alexa Lee: Hi, thank you. My name is Alexa Lee and I'm a Senior Manager of Global Policy at the Information Technology Industry Council, ITI. ITI is a global industry association representing over 75 companies across the tech sector and we not only represent companies that are directly involved in the semiconductor manufacturing supply chain, but also the downstream users of the technology.

I want to thank the Commerce Department for organizing this timely discussion. And in the interest of time, I will dive right in. Semiconductors are vital to U.S. economic competitiveness and national security. Many emerging technologies such as 5G, IOT, AI, and quantum computing all rely on semiconductors. We welcome President Biden's EO on America's supply chain and the recent announcement in the infrastructure package calling for $50 billion dollars to fund the CHIPS for America

Act. ITI believes that such incentives can increase domestic manufacturing research and design capacity to ensure a resilient supply chain. Next, I will offer eight high level policy recommendations. First, strengthen U.S. leadership in the semiconductor industry to enhance economic competitiveness, bolster national security, and drive innovation across all sectors by supporting increased production of semiconductors and their raw materials in the United States. And second, prioritize funding to enhance U.S. semiconductor ecosystem. ITI encourages the administration to provide incentives to increase domestic semiconductor manufacturing capacity of both leading edge and mature nodes, and to enhance semiconductor research, design, packaging, and prototyping. In particular, we encourage the administration and Congress to provide robust founding for the CHIPS for America Act. Further, those incentives should be available to all multinational chip manufacturers. It is also important to ensure that these programs are implemented without picking winners and losers through market distorting set-aside or quotas, even when addressing the short-term supply-demand imbalance. And third, utilize tax policy to encourage greater investment in the United States such as maintaining a competitive corporate tax environment, offering investment tax credits, and ensuring companies may continue to deduct R&D expenses. And fourth, maintain an innovation-forward economic policy that promotes overseas market access for global sales, which enables robust reinvestment of revenues in R&D. And number five, strengthen America's technology workforce by investing in advanced manufacturing skills and STEM education. Well at the same time support immigration policies to attract the best and brightest foreign talents to the United States. Number six: Enhance cooperation with global partners and allies to ensure stability of the global semiconductor supply chain by convening supply chain reviews, organizing tech sector-specific dialogue, and increasing digital trade partnerships through bilateral, regional, and multilateral engagement. And number seven: Address unfair Chinese trade practices by building upon existing U.S. work streams to address expensive Chinese government subsidies and unfair practices that do not follow international trade rules. And last but not the least, support public-private partnership by convening industry and government experts to develop a coherent, streamlined, and holistic approach to address semiconductor supply chain issues. And one good example of that is the DHS Supply Chain Risk Management Task Force. So for that, I conclude my remarks and thank you for the opportunity to share our views and I look forward to future conversations. Thank you.

Moderator: Thank you so much for speaking today. Next we have the Coalition of Services Industries, Christine Bliss.

Christine Bliss: Thanks so much. And I really appreciate the opportunity to present at this virtual hearing and to also submit comments on behalf of my members. I'm Christine Bliss. I'm President of the Coalition of Services Industries. We advocate for policies to facilitate the growth of the services economy and digital economy through trade. Our members include companies from a wide array of services sectors from information technology, to financial services, to express delivery logistics, media and entertainment, distribution, retail, and professional services.

CSI appreciates the need identified by the Biden Administration to secure resilient, diverse, and secured supply chains that support the U.S. economy and national security. As many services have become digitized, I think the percentage now is more than 60 percent, CSI members have come to depend in particular, more than ever, on semiconductors as an essential tool to enable the digital delivery of services. The COVID pandemic has accelerated the shift of services online, and the need to maintain

social distance and physical lockdown has led to a sharp spike in demand for services such as online commerce, online healthcare, financial services, and digital communications.

It's important to note that digitally delivered services have steadily grown to become an invaluable component in U.S. manufacturing and agricultural exports, as well as other sectors across the economy. Such traditional industries such as manufacturing and farming are increasingly likely to depend on digitally enabled services such as online data storage, digital communications, inventory management tools, logistics, and online banking and finance. American services make traditional industries like manufacturing and agriculture more internationally competitive. One study found that almost 30% of the value of manufactured U.S. exports is from services. In short, services are a critical component of the U.S. economy, and I'm here today because U.S. service suppliers as well as their counterparts in other industries depend on data flows over networks that are powered by semiconductors. So it's critical for the service sectors industry's success that we work to ensure an adequate and stable supply of semiconductors. And as for this reason we support U.S. Government efforts to diversify the geographic base of semiconductor manufacturing, including by promoting more production here in the United States.

While U.S. companies are world leaders in providing electronic design architecture software for semiconductor design, the current market for third-party manufacturing of semiconductor design is highly concentrated abroad. Over 80% of advanced contract manufacturing capacity globally is held in Taiwan, and it's not only expensive but also time-intensive to build new semiconductor manufacturing fabrication facilities. We believe the U.S. government must provide economic incentives to level the playing field. Such investment should be prioritized at the leading edge of the semiconductors technology, but it should also recognize the value of ensuring adequate supply of less sophisticated forms of chip architectures such as the eight-inch wafer. We have provided further detail on this in our written testimony. It's worth highlighting that in any effort to diversify the global supply chain for semiconductors, we must be sure to closely coordinate with our close allies and trading partners. Also, as part of the investing in our semiconductor manufacturing industry, it is essential for the U.S. Government to prioritize investments in scientific and engineering talent, particularly in areas such as electrical engineering, material science, solid-state physics, and computer science programs.

CSI supports significant expansions of government funding for R&D, especially relating to manufacturing. The incentive programs for U.S. semiconductor design and manufacturing in the CHIPS for America Act, which were incorporated in the FY 2021 NDAA, should be fully funded. This would help launch the process of establishing a domestic trusted and assured semiconductor manufacturing base. Not only will developing a secure supply of semiconductors in the United States address national security concerns, but it will also create highly skilled jobs and encourage the development of a domestic supply chain to support design and manufacturing activity. In addition, tax incentive programs and credits should be considered to incentivize companies to invest in large-scale domestic manufacturing efforts and the ecosystem that supports those efforts, including R&D and design. As one final point, in light of the current supply shortage, we urge the government to refrain from any intervention in the market to direct scarce supplies of chips to particular industries. Such actions could cause unintended distortions that would harm services or other industries with negative economic consequences. I appreciate the

time to provide this oral testimony today. As I said, we provide much more detail in our written comments and I once again thank this panel for the opportunity to testify today.

Moderator: Thank you for joining us today and speaking. Next we have IDEMIA, Mr. Brendan Peter.

Brendan Peter: Hi, Brendan Peter here. I'm the Vice President of Government Relations for IDEMIA, and IDEMIA thanks you for the opportunity to participate in this forum, as well. IDEMIA is not a consumer brand, many are aware of, but I am quite confident we are in your wallet and on your lanyards. IDEMIA is the world's largest leading global identity solutions company, and we produce hundreds of physical and digital identity solutions around the world. We are a large biometric hardware and software provider and we produce a wide range of chip-based identity credentials here in the United States and globally. Beyond that, we are also the world's number one leading payment card provider and what I would like to speak to you a little bit about today is some of the specific implications we see resulting from the current shortage on the financial services sector.

So as I mentioned, IDEMIA is the world's largest, number one payment card provider. And if you look at any credit card that's in your wallet, odds are we manufactured that on behalf of the bank that you received it from. We work with more than 1,900 financial institutions and fin-tech companies around the world and in the United States, we deliver more than a third of all of the payment cards that are issued annually by financial institutions.

In the U.S., that runs in the magnitude of hundreds of millions of cards per year in the United States. And in addition to that, IDEMIA is also one of the world's largest SIM card providers. We supported more than 500 mobile operators across the globe in supplying them with SIM cards that are in your mobile devices to provide enhanced connectivity and e-commerce solutions. In the U.S., those solutions range from legacy 3G chips to current 5G chips.

So I wanted to just spend a little bit of time and you know dovetailing a little bit off just a comment that was made by the last speaker about prioritization and ask if you know in a similar way we're seeing very direct prioritization in the market today, and I want to call to your attention the need to be certain that current supply chain interruptions do not affect the global financial system. You know we've seen, as a result of direct intervention by Chancellor Merkel and other world leaders in weighing in directly with political leadership and Taiwan and other bases of major foundries, some very specific directions and prioritization of chipsets to certain industries, and I couldn't agree more with the comment from the last provider. But I want to make it plain that from our perspective, there are very real near-term supply chain risks that we have to work to remediate and impacts on the global financial system was something that would be disastrous. You've heard a lot already from a range of companies about supporting domestic manufacturing capabilities, and IDEMIA certainly supports that as well. But I think we need to be focused on both longer-term solutions, which we would view Chips Act funding aimed at, but also addressing the real world supply chain constraints that we are experiencing every day.

We're in conversation with our chip suppliers every day, and we commit to hundreds of millions of cards for financial institution years in advance and any disruption to that is something that would impact us negatively and would impact any consumer. I think one thing to remind you of and my request and my admonition is for a very specific direct sectoral engagement with the financial services and telecom sectors to get a better sense of the downstream impact because unlike a one-time per five-year

purchase like an automobile, you know, credit cards and SIM cards are constantly evolving supply chains. Banks are issuing hundreds of millions of new cards to customers every year. They're replacing cards that are lost or stolen and they're replacing cards that run to their normal expiration date that mean that today's issues of the supply chain considerations have to be managed in real time. And I'm happy to say that we're not facing and are not projecting any immediate deficit that would impact the U.S. market, but we're very concerned about the continued prioritization of additional markets and the pressures that our manufacturing providers are facing to prioritize certain supply to certain sectors based on political pressure. So we're committed to working with the U.S. Government for both short and long-term solutions. And really my only request as part of this conversation is that you know, we're hearing so much relative to the auto sector which is certainly important, but I think we need the whole of government to take a whole of the economy look at all of the downstream impacts and make certain that were architecting solutions that satisfy both short and long-term demands and the supply chain that we need to address.

So that's all I have to say. I really appreciate the time and we look forward to working with you as you continue to deal with these issues.

Moderator: Thank you. We appreciate you joining us today. Next we have Linton Crystal Technologies, Todd Barnum.

Todd Barnum: Hi, I'm Todd Barnum. I'm the Chief Operating Officer for Linton Crystal Technologies and a lot of the supply chain discussion we've talked about today starts with wafers or chips, but I want to discuss how we get to wafers, because wafer manufacturing is the foundation of a lot of this supply chain and its absent here in the United States. At Linton Crystal Technologies, we design, develop, and manufacture the machines that are used to grow silicon ingots. They're normally long tubular, but these are all sliced up (if you've got video) into wafers. Variants of these machines are used in both the solar and the semiconductor industries and I do want to draw a correlation with the solar industry because it's much tighter than people realize; solar is a semiconductor, just a very simple one, but solar wafer manufacturing is also absent here in the U.S. Little bit about our company, it was founded in 1954 as HamCo Machine. We've been bought and sold multiple times, we're small. In 2013 our former U.S. ownership sold us to Dalian Linton NC Machine in China because our U.S. owners had failed to capitalize on the Chinese market. At our peak in 2008 we were about 90 million in sales here in the U.S. and Europe with a little over 180 employees. At our transition to Dalian Linton we were at our lowest point seven employees, but we've had continued effort and investment and we're now 30 plus U.S. employees and only small, 6 to 10 million, in U.S. sales. A majority of our sales, over a hundred million, are done through our Chinese parent over in China. My interest here in this forum is keeping jobs for my people here in the U.S., growing the U.S. presence and capabilities, strengthening the supply chain and making sure that there's a future for wafer production. I think strengthening the supply chain starts with wafers. And I'll talk about wafers briefly, I'm only talking 300 millimeter or the 12 inch wafers here. As a more advanced manufacturing node, there's not enough time to talk about eight inch or solar or alternative like the gallium nitride. But according to data from semi.org, in 2020 the average number of wafers purchased per month, is 6.5 million. Less than 5% of that, around 300,000, were sourced in the U.S., and that's not a production level on the scale of somebody like TSMC or Intel or GlobalFoundries is going to need. That's more R&D type. And to put it in perspective… so one of my crystal machines

running optimally produces about 10,000 wafers a month. So that's 6,500 tools to produce those 6.5 million wafers. That means 30 are here in the U.S. And for comparison the municipality of Beijing has its own five year plan and they have targeted production of 500,000 wafers by 2025. So that's almost double the capacity of the entire United States in just one small area of China and that's just a local plan. The national plan is enormous and all of China is investing. For the U.S. to be competitive in this I'd say we need manufacturing capacity of at least 20% of that 2020 total but that puts us at 1,300 machines. And that's just mine. It's not everything else that goes into making that wafer and you've got to move fast because factories take time, machines take time to build, all the operations honing. That's a couple years out. So we need a long-range plan. And being fair, the main reason why they're not produced here, is it's cheaper to do it somewhere else. Factories, equipment, energy and labor are all more expensive here. So in order to strengthen the supply chain here, I would say we enable U.S. investment with incentives instead of doing penalties like tariffs. I think grants, subsidies, tax credits, limited exemptions on the 301 tariffs to repatriate some items wouldn't hurt either, for my personal company, that's how I can speak. If we had a robust super research and development tax credit that enabled me to write off a larger portion, much larger portion of the development expenses, coupled with some manufacturing incentives or even potential supply contracts that just state that it has to be U.S. origin equipment, it'd be easy for me to convince the rest of the board to invest our money into the United States because we'd show we're making money and I think that's the case with most manufacturers in this entire chain regardless of ownership. If you make it easy to locate operations here and you make it simple to make money, they'll follow the path of least resistance, you know. And as a leader of this business, and as a U.S. Marine, I do have a real interest in seeing this supply chain strengthened and with efforts like this I have faith that it will happen. Thank you.

Moderator: Thank You. Next we have Seagate Government Solutions, William Downer.

William Downer: Thanks Erika. Thanks for BIS for hosting this. I am Bill Downer, Vice President of National Programs for Seagate Government Solutions. Seagate Government Solutions is supportive of the Risk of the Semiconductor Manufacturing Advanced Packaging Supply Chain Report called for by Executive Order 14017, but we see a significant value in expanding the scope of this review to better incorporate the broad array of technologies which are critical to the safety, security and growth of the microelectronic industry including data storage. The National Defense Authorization Act of 2021 calls for creating helpful incentives to produce semiconductors for America and mandates several Federal actions to secure the security of the semiconductor related supply chain. In particular, Seagate sees a need to prioritize the Department of Commerce study on the status of microelectronic technology in the United States, which is called for in the fiscal 2021 NDAA. The study requires the secretary to assess the broader capabilities of the U.S. Microelectronics industrial base to support the National Defense. In light of the global nature and interdependence of the supply chain with respect to manufacture design and end use, Seagate firmly believes that data storage needs to be included on the list of critical technology areas impacted by potential disruptions in the production of microelectronics and it is a potentially real area of vulnerability in the microelectronics supply chain. Data that feeds sensor systems, weapon systems, information and communication technology systems sits on various storage devices at many different points in the execution and use of those systems. As the U.S. Government and American industry continue to move to systems using data analytics, artificial intelligence and machine learning, secure storage devices from a U.S. based manufacturing process become a very important component.

Seagate Government Solutions asserts that storage devices should be manufactured and sourced in the U.S. Today nearly all storage devices are manufactured in non Trade American Agreement Act countries. Not recognizing this supply chain vulnerability puts the U.S. at a security risk and a risk of not having access to these critical components. As part of the semiconductor supply chain analysis we recommend that board and device level components that are critical to the executions of weapons, information technology, and yes, Automotive be evaluated. Today's devices such as solid-state drives, random access memory and storage class memory are examples of such critical components. We thank you for the opportunity to speak today at this forum.

Moderator: Thank you. Next we have Hemlock Semiconductors, Philip Dembowski.

Philip Dembowski: Can you hear me OK?

Moderator: Yes.

Philip Dembowski: Hello. Can you hear me? So hello. Good afternoon everyone and thank you for the opportunity to speak today. My name is Phil Dembowski and I'm the Senior Vice President and Chief Commercial Officer at Hemlock Semiconductors, one of the world's leading producers of polycrystalline silicon or polysilicon. I'm glad I'm going after Todd from Linton Crystal today as his equipment is what turns our polysilicon into wafer, into semiconductor wafers. So today I am speaking, I should probably turn on my video. Hold on one second. There you go. So today I am speaking on behalf of the other two U.S. polysilicon producers Voelker Polysilicon North America and REC Silicon. These U.S. polysilicon producers have invested approximately ten billion dollars in manufacturing facilities in Michigan, Tennessee, Washington State and Montana and provide high-wage, high-skilled jobs for specialized engineers and technicians. The U.S. polysilicon industry has traditionally been the global leader renowned for its leading technologies, innovation, product quality, low carbon footprint, as well as cost competitiveness. Polysilicon is the foundational material necessary to produce semiconductors, photovoltaic solar panels and next-generation batteries. As a result, the U.S. polysilicon manufacturing sector is vital to our current and future economic energy and national security and an all of government response is urgently needed to preserve the critically important U.S. polysilicon industry and protect its contribution to the entire semiconductor and solar supply chains. It is important to understand the essential steps in the polysilicon manufacturing value chain that result in finished semiconductors and solar cell. It's also important to recall that much of the innovation responsible, the creation of these products, originated in the United States. Briefly the manufacturing value chain comprises four key steps: (1) the production of polysilicon, (2) the production of ingots from polysilicon that are then sliced into wafers (3) The production of semiconductors or solar cells from those wafers and (4) the assembly of final products using semiconductors and solar cells like most of our electronic devices and solar panels. The primary feedstock for polysilicon is silicon metal which is derived from the mining of quartz much of that from the United States. Polysilicon production is a highly complex and technologically sophisticated process that results in products with extremely high purity levels. High quality semiconductor electronic grade polysilicon is typically produced at purity levels greater than 11-9. That's 99.999999% while solar grade polysilicon is typically produced at purity levels greater than 9-9. To put that into perspective 11-9 purity of semiconductor grade polysilicon means impurity levels less than 10 parts per trillion, which is equivalent to 1 second in 3,200 years or one grain of sand in 16 Olympic-size swimming pool. This is some really pure stuff. In fact, it's one of the purest materials on Earth and since

Todd did a demonstration, this is a little nugget of polysilicon that's not so pure now because I'm handling it, but when we produced it was very pure. In order to ensure domestic capacity for semiconductor grade polysilicon, U.S. polysilicon production operations must be economically viable. However, companies that manufacture semiconductor grade polysilicon depend on high volume production of solar grade polysilicon to achieve the necessary economies of scale and capacity utilization rates for highly capital intensive manufacturing facilities. Thus without a robust solar supply Chain in the U.S., including ingot, wafer cell and module production polysilicon producers will not have a reliable customer base and as a result will be unable to produce polysilicon for either the semiconductor or the solar markets. The security and resiliency of the U.S. semiconductor supply chain and the preservation of U.S. technological leadership is dependent on the secure and reliable supply of its foundational material: semiconductor grade polysilicon. Advancements in new cutting-edge semiconductor device technology all rely on advancements in performance and manufacturing of polysilicon to realize performance improvements and supply capability. This supply is inextricably tied to the foundational material for the domestic solar supply chain: solar grade polysilicon. U.S. technological leadership and U.S. production of semiconductor grade polysilicon is at risk due to Chinese actions to increase its dominance of both the semiconductor and solar supply chains, as a result of these actions U.S. polysilicon producers have been cut off from the Chinese market which represents over 95% of the global solar grade polysilicon market and our direct and immediate customers in the solar industry no longer exist in the United States. The U.S. government should recognize the existential risk this poses to the semiconductor manufacturing base and in national security. As detailed in our written comments, the U.S. government should take appropriate actions to support U.S. production and to increase demand for U.S. origin polysilicon. Taking these important steps, would shore up the U.S. polysilicon industry and thereby strengthen the foundation of the U.S. semiconductor and solar energy supply chain. Thank you very much and I'll turn it back to you Erika.

Moderator: Thank you very much for joining us today. We appreciate those comments. Next we have, yes… and a show and tell, definitely… next we have MITRE, Dr. Shamik Das.

Dr. Shamik Das: Hi, my name is Shamik Das as you said and I'm a Division Chief Engineer at the MITRE Corporation in McLean, Virginia. And we definitely appreciate the opportunity to speak to you today on the record about this topic which is of essential of national importance. I want to introduce MITRE just briefly. We're a not-for-profit public interest company with over 60 years of experience operating federally funded research and development centers (FFRDCs), which work together with government and the private sector to drive innovation on technology, management, and policy issues. MITRE also operates MITRE labs and we have a tech foundation, MITRE Ingenuity, that works with the private sector for public good and brings an industry perspective on this topic. We excel in developing whole-of-government solutions and in driving cross sector collaboration to address our nation's most pressing challenges. This broad and neutral perspective combined with our expertise in microelectronics and supply chain risk management enables us to provide a unique value to the Department of Commerce as you respond to this executive order. We made a detailed written response to your request for comment and what we want to spend our time here is on the three key recommendations that we wish to emphasize.

The first is that the U.S. needs to develop and proliferate a comprehensive national semiconductor strategy. Given the criticality of semiconductor supply chains to U.S. national and economic security and the complexity of the issues affecting them, the government needs a clear cohesive national strategy for promoting U.S. leadership of the semiconductor supply chain of the future both for the coming decade and also for the disruptive technologies beyond. Without further strategy the U.S. runs the risk of defaulting to a haphazard diffusion of government investment and a patchwork of policies and programs that are not mutually reinforcing. Much of the strategic discussion and public discourse around U.S. semiconductor resurgence has been focused on the investing and the on-shoring of manufacturing capability. And this is critically important, but without a clear and comprehensive strategy we could fall into a more reactive posture rather than driving investments that address both the near term vulnerabilities that we see and also build toward a longer-term U.S. plan for 2030 and 2040. The strategy also needs to address investments in workforce to increase the number of STEM graduates entering the semiconductor industry and to encourage their attention in the U.S. Cooperation with allies to cultivate alternative sources in areas of particularly high dependence on high risk trade partners and effective coordination on alignment across government on specific shared priorities and objectives that drive U.S. innovation leadership and security.

Our second recommendation is that the government establish a public sector industry focused DARPA-like capability for semiconductors. To lead in critical technologies and arenas of the future the U.S. needs to capitalize on areas where it is already the global leader, but it is no longer enough simply to invest in fundamental research for next-generation technology. We must actively bridge the gap to commercialization that promotes public outcomes. To do so the Department of Commerce should establish a public sector industry-engaged capability with the mandate, resourcing, and coordination to make strategic investments in next [inaudible] development, a promising research that is still several years away from commercial adoption. Through this new organization, the U.S. should invest at scale to ensure effective centrally coordinated and accountable investment against this strategic plan. In an industry where individual facilities cost billions of dollars and state-of-the-art equipment can cost over a hundred million, the only way to create new substantial capabilities is to make large, bold, concentrated investments that are organized according to a cohesive strategy.

Third, the U.S. must develop a multi-dimensional supply chain monitoring and resilience capability to obtain the data to drive investment and policy decisions. The U.S. government has many levers at its disposal to help address challenges facing critical supply chains that affect our national security and economic interests, but it needs early insights so that policies or actions can be taken in near-real time to address specific issues. This capability could provide data and insights on capacity, supply and demand signals, and critical issues and threats. A task force comprising the Departments of Commerce, Treasury, State and Defense could leverage this information to develop effective proactive responses to emerging risks. The U.S. cannot afford to wait until moments of crisis to begin filling supply chain gaps where there is a particular vulnerability to denial or supply shocks. In particular by standing up this capability the Department of Commerce can leverage Title 99 of the 2021 NDAA to promote a domestic supply chain that has increased resiliency to withstand supply chain denial and supply shocks. If the U.S. can capitalize on the recent surge in attention to the semiconductor supply chain security issues across government, industry, and the public discourse to make substantial strategic well-implemented

investments it will be well positioned to lead the semiconductor supply chain of the future. Thanks again for the opportunity to speak.

Moderator: Thank you very much. Next we have Dr. Michael Fritze with the National Defense Industrial Association, Electronics Division.

Dr. Michael Fritze: Let's see if my videos on. Ahhh my video is on very good. Okay. Thank you very much Erika. So my name is Mike Fritze, and I'm a Vice President at the Potomac Institute for Policy Studies, a Science and Technology based think tank. I'm representing however, the Electronics Division of the National Defense Industry Association. So I guess I'm somewhat representing the defense industry in this in this conversation. I'll say a few minutes of work about what NDIA is all about followed by recommendations that we submitted in our written comments. The National Defense Industry Association is focused on getting situational awareness of coordination and dialogue between industry and the university and academia and U.S. government and DOD stakeholders. There's 28 divisions and 30 chapters with 1,600 corporate members and sixty thousand individual members. It represents small, medium, and large defense industry based companies, both traditional and non-traditional, and I'd like to say we've been working very hard to make sure that the non-traditional commercial members are well represented and I believe that they are these days. The particular piece that I represent here is the Electronics Division and that work is an outgrowth of the Trusted Microelectronics Joint-Working Group that took place a few years ago recognizing the importance of this problem to the defense industry stakeholders to bring people together and focus on this issue. We really focus on microelectronics issues with the priorities on access and security. We have good representations in both the traditional defense industry companies, like Lockheed and Northrop Grumman, and non-traditional ones like Intel and Micron, and a number of small companies, for example, so we have a pretty broad representation and we held a very nice annual meeting very recently at the end of January focused on great power competition with China, the Chips AFA legislation where we had a great session including people from the Hill speaking about the legislation and talking to folks from SIA and other industry representatives. We had a DARPA overview of what the ERI is doing, and EDA security session and hardware assurance very focused on current topics. But I'd like to now focus on the recommendations that we did. I won't cover our written comments. You have that to read at your leisure and I'd like to focus specifically on the recommendations. I'm actually glad I came after Shamik at MITRE because there is some resonance with that. In fact our very first recommendation resonates very strongly with Shamik's comments. We believe very strongly that the National Security Strategy needs to be developed for semiconductors that includes input from the U.S. government, industry, and academia. We need to focus on what the priorities are, what the desired outcomes are and what the essential technologies are. We need to define and identify them for government action. That's actually very important and something that we really haven't done in a cross-cutting way. So I resonate very strongly, or rather, we resonate very strongly from NDIA with Shamik's comments. Going through a couple of other recommendations that we have, and first off I'd like to thank the Commerce Department for specifically taking industry input in this endeavor, which is very important, we feel and we applaud the outreach to industry in this.

So number two. We believe the export rules need to be clarified. Right now there's a web of complexity and that has to do with, partly with the export control legislation from the 70s, which is many decades out of date. We failed on substantive export control reform and we really need to do something about

it. We're shooting ourselves in the foot against our competitors with export control limitations, but even on the small stage things like post-Fab customization of chips, which is becoming more and more common, needs to be clearly defined in terms of what the export control regulations are. So we need fundamental export control reform to strengthen our semiconductor position. Number three, we need to provide tax incentives to industry, which means we need to fully fund the CHIPS and NDAA legislation that calls for such tax incentives. We need to incentivize, I think what we're saying in the short term is the carrot works better than the stick. So rather than just focusing on defensive measures to protect us, working on the offense to incentivize good behavior is actually very important and so tax incentives which are a very important part of the CHIPS NDAA legislation are extremely important here. We need to fully fund the CHIPS and NDAA legislation, a number of other speakers have already said that. We feel it clearly falls into long-term and short-term thrusts. The shorter-term thrusts are what our needs are today so prioritize our needs today and make sure that we have good access to the capabilities that we need for today. Longer term we need to be world leaders in research. So we need to invest in emerging technologies and our industry stakeholders feel that the immediate [inaudible] there would be advanced packaging and heterogeneous integration. So we need to be world leaders in this area of emerging technology and we need to invest in that. So there's both the near term and a short-term, near-term and long-term focus to the CHIPS and the AFA. The final comment I have on the CHIPS and AFA is that it's more than just Fabs. Fabs are great and Fab access is very important. But in order to have something practical and in order to have a capability you need to actual access infrastructure. So that means you need the design and testing infrastructure that supports Fab access. A Fab by itself is of limited usefulness. We need to have an access infrastructure, a robust access infrastructure in place. That's actually very important. Finally, I'd like to comment, I think I resonated a bit with the GlobalFoundries speaker at the beginning that there's a broad variety of technology that's required by systems companies state-of-the-art is of course, very important for bleeding edge. But most of the things that we have in systems is a number of generations older if not much older. So we need to take into account what the actual systems companies need to be economically viable. Number five we believe very strongly. All right, I will end, we believe very strongly that the DIB industry needs to be represented in a strategy advisory panel. That's exactly what's happening here in this activity. So with that I've covered most of our recommendations the rest of them are in the written comments that we made and once again, I really applaud Commerce on behalf of the stakeholders of the NDIA that they're actively seeking out input from industry in this. This is the way to get things done. So, thank you very much.

Moderator: Thank you very much. We are really glad to host this Forum today. That wraps up our group two speakers. So I will hand it back over to the USG panel that will ask questions of our second group of eight speakers. As a reminder if you are one of those eight speakers and would like to respond, please use the raise hand function and we will call on you to unmute and answer. We'll do our best to allow all those interested in answering the questions a chance to speak while also considering our time constraints. USG Panel.

Michele Schimpp: I would welcome again input on the prior question – which is what are the unique challenges and risks that are encountered by the small businesses in the semiconductor supply chain?

Dr. Michael Fritze: So am I on? So we do have small businesses that are part of the NDIA and I would say actually that this is an example where their lack of market driving, they can't really drive the market so having access is a huge issue. So for the government to step in and work policies to provide good assured access to the basic technologies is critical and there's a common interest here because the government is also a small customer of this industry. So there is total resonance between government needs and a lot of the small companies in which access to technologies is key.

Moderator: And next we'll go to Dr. Shamik Das.

Dr. Shamik Das: Yes, thank you. Thank you for the question. I like to add it is incredibly difficult in today's economic environment for small business to get involved in this, you know in this innovation ecosystem to bridge the barriers to market access. Actually, market capital investment is a huge barrier. It's difficult to introduce new ideas as a start-up into the hardware ecosystem and government can play a huge role in investing in these small companies in helping them to bring their ideas to market.

Moderator: Thank you. Any additional questions from the USG panel? No. Okay. We will move on to Group 3. Kimberly Ekmark with SEMI.

Kimberly Ekmark: Thanks Erika. My name is Kimberly Ekmark. I'm the Director of Public Policy and Advocacy at SEMI. I want to thank the Department of Commerce for holding this forum to discuss risks in the semiconductor manufacturing and advanced packaging supply chain. SEMI appreciates the opportunity to appear before you today in support of the complete set of comments we submitted for the record. SEMI is the industry association representing the global electronics manufacturing supply chain and we are more than 2,400 members worldwide including over 400 members in the United States. SEMI represents a full range of U.S. semiconductor companies including design, automation, and semiconductor IP suppliers, device manufacturers, equipment makers, materials users, software designers, and sub component suppliers. Semiconductors underpin all electronics and information technology enabling innovation and growth and countless other industries while powering the hardware for artificial intelligence applications, 5G infrastructure, and quantum computing. Nearly all items that run on electricity incorporate semiconductors and disruptions in the semiconductor supply chain can have serious consequences and downstream industries rely on these chips including IT, medical devices, automobiles, defense, critical infrastructures to name a few. Today the U.S. share of global integrated circuit capacity is 12 percent down from 24 percent in 2000. Over that same period South Korea has grown by 11%, Taiwan 12%, and China 15%. The most advanced process node capability is currently only available in facilities outside of the United States and back-end assembly has diminished to 3% in North America.

Semiconductor manufacturing is among the most complex production process in any industry. The supply chain is highly integrated and globalized from growing the silicon ingots, creating raw wafers, front end fabrication of the wafer, and back end assembly test and packaging. Each step requires significant capital investment, sustained and costly research and development, and its own supply chain of countless firms providing components and materials. Supply constraints whether they be in devices, equipment, or materials can impact the entire supply chain and lead to semiconductor shortages which can result in what went down at electronic factories and have ripple effects throughout the economy. Additionally there is little excess capacity available in the U.S. or elsewhere to absorb increasing demand

or production cuts. Recently we've seen several risk factors that have led to significant disruptions in the supply chain from natural events, including storms, fires, and earthquakes causing power outages and other production stoppages, geopolitical tensions resulting in dueling export control measures and trade wars leading to supply chain uncertainty and increase tariffs, and of course the covid-19 pandemic that has caused unprecedented work, transportation, and travel disruptions. Building a stronger and more resilient semiconductor supply chain in the U.S. will be facilitated by policies that help semiconductor companies throughout the entire supply chain grow and innovate. SEMI fully support the CHIP for America Provisions that were passed in the FY 2021 NDAA and President Biden's call for $50 billion to fund these programs. We want to note the importance of upstream items that are critical to manufacturing facilities and ensure incentives are available and research is focused throughout the entire supply chain, including semiconductor equipment, materials, and design software. The federal investment tax credit for semiconductor manufacturing facilities and equipment included in the Chips for America Act would quickly help close the cost gap and provide certainty for investments in new and expanding Fabs, creating thousands of jobs, and reversing the decline in America's share of global semiconductor manufacturing. The U.S. could continue to lose ground in semiconductor manufacturing and new facilities will take years to come online. A tax credit will impact investment decisions quickly and is a reliable method used in countless other industries to incentivize U.S. manufacturing. In addition to incentives for manufacturing, investment in semiconductor research and development is vital to keep pace with technology innovation. While semiconductor companies continue to reinvest a significant percentage of revenue and profits in R&D, federal spending has declined over the past few decades. In 1953 the federal government funded over 50% of total R&D spending and today that is closer to 20%. Proposals to invest more in R&D for technology sectors, like semiconductors, will help bolster the industry and continued innovation. Additional pro-growth policies are key to strengthening the semiconductor supply chain in the U.S. like workforce policies that promote STEM education and enhance diversity equity and inclusion in the workforce, and trade policies that open markets for U.S. products. Equally as important as policies that promote growth in innovation, we must preserve strength and avoid policies that weaken the supply chain or undercut pro-growth initiatives. Semiconductors are a significant U.S. export and roughly 90% of semiconductor equipment and material sales are made in facilities outside the United States. Export markets are essential to the semiconductor industry and they are the foundation of U.S. headquartered companies market share positions. Export controls and U.S. origin items should be narrowly tailored and to address specific national security concerns and implemented multilaterally. Unilateral controls contribute to the perception that the supply of U.S. origin items is unreliable and leads to customer efforts to avoid or design out U.S. origin products and technology. Finally, we must ensure that federal incentives and manufacturing and R&D are not negated by corporate tax policies that would weaken the competitiveness of the U.S. industry in a global market. Competitive corporate tax policies are important foundations for a strong and resilient U.S. supply chains. The policy proposals that are being discussed are a critical first step to improve the competitiveness and strength of the semiconductor manufacturing supply chain. SEMI urges the administration and Congress to avoid eroding that benefit and the benefit of the proposal by implementing other provisions that will make the industry less competitive, weakening the supply chain in the process. Thank you again for your time and SEMI looks forward to working with you on this very important issue.

Moderator: Thank you very much. Next we have Falan Yinug from SIA.

Falan Yinug: Thank you very much. My name is Falan Yinug. I'm Director of Industry Statistics and Economic Policy at the Semiconductor Industry Association on behalf of SIA thank you for the opportunity to speak today. I would like to make four points in my comments. One, the global semiconductor supply chain provides enormous value in promoting innovation and reducing costs. Two, it would be unrealistically expensive and unproductive to attempt to replicate the global supply chain in any single country in an attempt to achieve self-sufficiency. Three, the global semiconductor supply chain however, faces various vulnerabilities due the concentration of certain activities and sources of inputs and specific geographies. And four, the U.S. should adopt smart policies to eliminate or reduce these vulnerabilities and enhance the U.S. economy, national security, and supply chain resilience. Semiconductors have driven transformative advances in nearly every modern technology from computers to mobile phones to the internet itself and they play a critical role in innovations in automobiles, medical devices, manufacturing, energy production and other key areas of our economy and society. The U.S. semiconductor industry has for decades led the world in semiconductor technology. This leadership is due in no small measure to its ability to leverage a complex global supply chain. The U.S. semiconductor industry relies on deep global supply chains and access to overseas markets to create value, drive innovation and reduce costs. The global structure of the semiconductor supply chain has enabled the industry to deliver continual cost reduction and performance gains for consumers, businesses, and governments who use semiconductors in the products they enable. The need for deep technical know-how and scale to design and manufacture chips has resulted in a highly specialized global value chain in which regions perform different roles according to their comparative advantages. Countries are interdependent in this integrated global value chain, relying on free trade to move materials, equipment, IP, and products around the world to the optimal location for performing each activity. Attempting to replicate the global semiconductor supply chain at any single country in an attempt to achieve self-sufficiency would be unrealistically expensive and unproductive. Researching, designing, and manufacturing semiconductors is so complex today that no one single country or one company can do it all alone. Such a hypothetical model of fully self-sufficient local semiconductor supply chains would require at least one trillion dollars in incremental upfront investment and result in a 35 to 65% overall increase in semiconductor prices and ultimately higher cost of electronic devices for end users. Clearly this hypothetical offer to global supply chains is a non-starter for the semiconductor industry and indeed the world. In the past few years, however, several factors have emerged that could put the successful continuation of the global semiconductor supply chain model at risk. While geographic specialization has served industry and its consumers well it also created potential vulnerabilities. There are single points of failure in the semiconductor supply chain that could be disrupted by for example, natural disasters, infrastructure shutdown, or geopolitical conflicts. Also, there are more than 50 points across the semiconductor value chain where one region holds more than 65 percent of the global market share. Examples of concern specifically to the U.S. are about 75% of semiconductor front end fabrication capacity is concentrated in China and East Asia and more than 60% of the world's back-end semiconductor assembly, test, and packaging capacity is in China and Taiwan, while the U.S. lacks any large-scale commercial state-of-the-art advanced packaging capabilities. Industry participants and governments must join in efforts to address these vulnerabilities to make the value chain more resilient while also continuing to facilitate worldwide access to markets, technologies,

capital and talent. The U.S. government will need to use a combination of smart policies to mitigate these vulnerabilities including targeted investments to fill high-risk gaps in their supply chains and collaboration with allies and partners globally. For innovation to thrive, the semiconductor industry needs targeted U.S. government policies and incentives that strengthen supply chain resiliency and expand market access while balancing the needs of national security. The immediate solution to these challenges should be focused. Competitive government incentive programs must support domestic semiconductor research and achieve a more diversified geographical footprint by building additional semiconductor and unique raw materials manufacturing capability in the U.S. and expanding production sites and domestic sources of supply for unique and critical material. Beyond targeted incentives, the government must guarantee a level playing field as well as strong protection of IP rights. The government must also take steps to further promote global trade and international collaboration on R&D and technology standards particularly with allied countries. In parallel, policymakers should step up efforts to address the shortage of talent that threatens to constrain the industry's ability to maintain its innovation pace through further investments in science and engineering education as well immigration policies that enable leading global semiconductor clusters to attract world-class talent. In addition, the government should establish a clear, stable, and targeted framework for targeted controls on semiconductors that avoid broad unilateral restriction on technologies and vendors while establishing market incentives for more assured sources for our military and critical infrastructure needs. Such well-modulated policy interventions would preserve the benefits of scale and specialization in today's global value chain structure while addressing supply chain risk with targeted investments to incent incremental capacity growth in the U.S. to domestic resiliency requirements and address worldwide market needs. This would ensure that the industry can extend its ability to deliver the continual improvements in semiconductor performance and cost that will make the promise of transformative technologies such as AI, 5G, IOT and autonomous electric vehicles a reality in this decade while providing domestic production capacity necessary for critical domestic applications. SIA appreciates the opportunity to provide its input today and we look forward to working with the administration on policies that will advance the competitiveness of the U.S. semiconductor industry.

Moderator: Thank you very much. Our next speaker is John Bozzella with the Alliance for Automotive Innovation

John Bozzella: Good afternoon. Thank you very much to the Department of Commerce and the Bureau of Industry and Security for hosting this Virtual Forum. It’s a critically important issue not only for the country today, but for the innovative technologies that will be key to our continued global leadership. We very much appreciate the administration's engagement on this issue and its commitment to identifying and resolving risks in the semiconductor supply chain. I'm John Bozzella, President and CEO of Alliance for Automotive Innovation. Alliance for Automotive Innovation or Auto Innovators is the singular, clear, and respected voice of the auto industry. We represent manufacturers that produce nearly 99% of new cars and light trucks sold in the United States as well as original equipment suppliers, tech companies, and others within the automotive ecosystem. As the nation's largest manufacturing sector the auto industry contributes $1.1 trillion dollars to the U.S. economy and represents five and a half percent of the country's GDP. As a significant engine for our nation's economy, the auto sector is responsible for 10.3 million jobs and $650 billion dollars in paychecks. As you're aware, the auto industry has been uniquely and significantly impacted by the current semiconductor shortage. The ongoing

shortage has forced automakers to halt production and cancel shifts in the United States with serious consequences for their workers and the communities in which they operate. Our current projections for 2021 show an impact as high as 1.3 fewer vehicles produced in the United States. While there is no consensus among our members on how long the shortage will continue to impact production, some companies are predicting up to six more months of additional disruption. Our immediate priority, and one that we appreciate is shared by the administration, is reducing the severity and longevity of the microchip shortage for the auto industry to protect American jobs and minimize the negative impact to the broader economy. Looking forward, many innovations that are underway in the automotive space including electrification, automation, and connectivity are highly dependent on semiconductors. Policies that can incentivize additional semiconductor capacity in the United States such as programs authorized under the Chips for America Act and included in the FY 2021 National Defense Authorization Act are essential to addressing the longer-term challenges. For this reason Auto Innovators strongly supports full and robust funding for the programs authorized under the Chips for America Act. The chips generally used in vehicles are not the same chips used in consumer electronics devices. As with many defense and industrial control user, auto production largely relies on chips made using mature nodes. These chips are more robust and reliable than the advanced node chips that are used in consumer electronics devices. That means these chips can withstand the challenging environments in which vehicles operate and can last a life of a vehicle. For this reason and given the impact on jobs in the economy, we suggest that at least some portion of any Chips for America Act funding be used to build new capacity that will support the auto industry. This can mitigate the risk to the automotive supply chain evidenced by the current chip shortage. In the midterm, Auto Innovators recommends enactment of a semiconductor manufacturing investment tax credit that can help companies offset the cost of creating new lines within existing facilities or reallocating current production to meet evolving needs. A significant investment in building additional semiconductor capacity is essential. We look forward to continuing to work with you to ensure that the United States continues to lead the world in innovation and in building a cleaner, safer, and smarter transportation future. Thank you.

Moderator: Thank you very much. Next we have Ann Wilson with the Motor and Equipment Manufacturers Association.

Ann Wilson: Thank you. Thank you very much for the opportunity to appear this afternoon. My name is Ann Wilson and I serve as a Senior Vice President of Government Affairs for the Motor and Equipment Manufacturers Association or MEMA. This afternoon. I'd like to provide an overview of MEMA's views on the semiconductor supply issues raised by President Biden's February 24th, executive order. MEMA represents more than 1,000 companies that manufacture original equipment and aftermarket motor vehicle parts, components, systems, materials for use in passenger vehicles and commercial trucks. U.S. vehicle parts manufacturers provide more than 900,000 direct American jobs making it the largest sector of American jobs and manufacturing jobs with a presence in all 50 states. It is important to recognize today that this crisis is impacting all of our members. Since the end of 2020 the U.S. vehicle industry was faced with an acute shortage of semiconductor chips as well as shortage of the motor vehicle grade wafers from which they are produced. Semiconductors are used in a wide variety of vehicle components to perform critical functions such as vehicle control, active and passive safety systems, emissions, and driver information. The manufacturer of these electronic components relies on semiconductor industry that in turn depends on the silicon wafer foundry industry. The current shortage

of motor vehicle semiconductors was triggered in part during the quarter of 2020 pandemic shutdown, which prompted silicon wafer foundries to reallocate production from motor vehicle sector to the consumer product sector. However, as motor vehicle production grew sharply in the second half for 2020 motor vehicle grade wafer capacity could not keep up with demand. As of April 2021 many U.S. motor vehicle plants have idled and or curtailed production due to the shortage of these key components. These shortages are expected to persist in 2021 in part because of that takes up to five months for foundries to retool, re allocate, or expand production. Recent other events such as the semiconductor Fab fire in Japan, shipping and [inaudible] delays, and natural disasters have further exacerbated this problem. Due to the shortage, the industry is anticipating an overall shortfall in motor vehicle production for the first three quarters of 2021 without adverse employment impacts both to the vehicle and vehicle parts manufacturers. There are lessons to be learned from the current motor vehicles crisis and for the overall long-term supply chain discussions. First, it is [inaudible] that combined demand for semiconductors from all technology sectors from the motor vehicles to personal consumer devices will only continue to accelerate. The demand for motor vehicle chips is likely to increase faster than any other sector. According to KPMG four trends - autonomy, electrification, connectivity and mobility as a service - will raise the semiconductor contents of cars by as much as 10 fold. Second, increasingly more sophisticated chips will be needed overtime as there is a greater news for micro controllers and other advanced technologies. The U.S. semiconductor policy objectives should be first and foremost to increase and diversify the local supply of all grades semiconductor chips, which in turn encourages more U.S. wafer and semiconductor chip production. However, as others have mentioned the cost of semiconductor plants range anywhere from 4 billion to 20 billion dollars. Some government assistance is necessary for the U.S. to complete globally. For these reasons, MEMA strongly supports funding of the Chips Act. However, the legislation must include appropriate motor vehicle production incentives. During consideration of the Chips Act, policy makers should consider three issues for increasing U.S. based production if the Chips Act funding encourages companies to source some of their best wafers in the U.S. That would be an important contribution to the increased global capacity and diversification of supply. Second, incentivizing chip manufacturing to produce chips and wafer components for the motor vehicle sector. Currently the vehicle sector needs mostly 200 millimeters semiconductor chips that are manufactured with mature but still vital technology for our sector, 5G, and other critical functions. Companies making semiconductor chips get a better economic return on state-of-the-art 300 millimeter chips for consumer goods and a few motor vehicle components such as microcontrollers. The Chips Act must incentivize manufacturers to produce both 300 millimeter and 200 millimeter chips and the wafer components for the vehicle sector. A requirement that portion of the chips grants go to companies that commit to building Fabs that have that capacity to manufacture motor vehicle grade semiconductor production would encourage balanced U.S. chip production. And finally, I would like to reiterate the stabling access to these necessary components is important for the U.S. Department of Defense. MEMA member companies support DoD's fleet vehicles as well as combat and land transportation vehicles that provides the support to our combat vehicles. [Inaudible] also pass broad R&D funding provisions and an extension of the current law providing full and immediate deductibility of R&D into 2022 and beyond. MEMA appreciates this opportunity to provide testimony this afternoon, and we look forward to engaging with you as you work on these issues. I'll be happy to answer any questions.

Moderator: Thank you so much. We're going to save the questions for the end of this group. But we appreciate that offer. Next we have Stephanie Hall with the National Association of Manufacturers.

Stephanie Hall: Hi. Thanks Erika. This is Stephanie Hall. I am Director of Innovation Policy with National Association of Manufacturers. We really appreciated the administration's focus on this issue and the Department's taking the time today to give this input and appreciate the opportunity to share our perspective here. The National Association of Manufacturers represents manufacturers of all sizes in every industrial sector and in all 50 states. Our broad membership includes key aspects of the semiconductor manufacturing supply chains and research and development to design, fabrication, packaging, and end use production. We also speak on behalf of a broad range of manufacturers, a full spectrum of end users that rely on chips for their manufacturing processes, and the products that they make. This broad view into the very real impacts of the current semiconductor supply chain challenge has provided a few key insights that we hope will be helpful to the administration and to the department as they continue their review of supply chain risks.

First, there's a lot at stake and second, our policy solutions must be geared toward reorienting the chips supply chain to the United States over the long term paired with strategic engagement with allies today that address the immediate and acute demands of the market. So first what's at stake. Many participants today have highlighted how a robust reliable semiconductor supply chain is essential for our nation's economic and national security leadership. Beginning the NAM completely agrees and I want to provide some precision to that very important point. Chips are a core component critical to innovation and production across the full manufacturing ecosystem. They're ubiquitous in everyday products from phones and laptops to water heaters and the cars we drive. They also enable critical infrastructure such as power grids, communication networks, and cloud computing. They're integral to U.S. aerospace and defense systems and are a key component powering the digital transformation that's underway in manufacturing 4.0 today. Disruptions to the supply of semiconductors can result in impacts across the supply chain of specific products and entire sectors. Taking just one example, passenger and commercial vehicles use chip-enabled electronics for essential and required components of their systems, including engine control systems and collision avoidance sensors. Shortages have recently interrupted delivery of these technical components and caused ripple effects across broader manufacturing supply chains of automotive vehicles and heavy duty trucks. In some cases, this has led to manufacturers having to reduce output and rolling production delays. These further disrupt predictability for the large and small suppliers that provide other inputs and component products to use equipment manufacturers. Looking forward there's a lot at stake as well. Persistent shortages can undermine COVID-19 response efforts as chips are necessary across the range of sectors that are delivering vaccines, medical devices, agricultural goods, and other essential supplies. Shortages can also impede anticipated increases in production and sales of COVID-19 recovery and threaten to delay progress on all infrastructure and digital transformation initiatives. The gap between demand and the available supply is expected to grow over the next five years. So what are some of the options? At the NAM we believe the policy approach should include measures to build our domestic semiconductor manufacturing capabilities over time as well as immediate efforts to support reliable supply chains among international allies. First and foremost the federal government should pursue programs and policies that encourage the expansion of domestic semiconductor supply chains. Last summer, the NAM introduced a proposal called Strengthening Manufacturing Supply Chains which provides a clear roadmap for growing domestic manufacturing.

We've provided the bulk [inaudible] as part of our written submission to the department. In short, it [inaudible] recommendations that are meant to encourage the next dollar spent to build manufacturing capacity is spent on growing the manufacturing base here in the United States. I won't go into all the specifics of the plan, but we'll highlight that many of those recommendations can and should guide policy solutions for semiconductor supply chains, such as tax credits to encourage domestic investment and tax law changes that would reduce costs to the manufacturers to hire and retain a pipeline of U.S. skilled workers. We also call for a public-private investment vehicle to provide funding and financing to companies of all sizes to support research into advanced manufacturing technologies. We also call for harmonizing sustainable permitting that's required before companies can break ground on major facilities. Second, as many have mentioned here today, the government should fully fund the Chips Act and speed up its implementation to boost domestic chip manufacturing. Establishing and expanding domestic chip manufacturing requires significant upfront capital expense. U.S. policy should incentivize the capital investments that support domestic manufacturing as well as the research and development and design efforts that support the semiconductor manufacturing ecosystem. Domestic manufacturing initiatives should support the full range of chips that commercial and public sector entities rely on including next generation wafers designed to support advanced processing performance as well as legacy chips to continue to support multiple commercial and government applications. Third, government should streamline export control policies to support U.S. competitiveness and semiconductor manufacturing. Fourth, we need to strengthen the manufacturing workforce, especially in STEM fields that support the chips manufacturing ecosystem. Lastly, boosting U.S. domestic capacity should be pursued along with prioritizing strategic collaboration with allies to support those short-term supply needs of industry and government and to enhance reliable diversified supply chains moving forward. We at the NAM recognize that building resilience supply chains for semiconductors and boosting domestic manufacturing capacity will require multiple policy solutions and sustained investments over time. The federal government can catalyze this transition by enacting the policy recommendations that we've provided in our written submission and in those highlighted here today while also pursuing an environment in trade, tax, regulatory policy, IP protections, and immigration reforms that support manufacturer’s ability to quickly innovate and build. Thank you so much. Happy to answer any questions.

Moderator: Thank you Stephanie. We're going to do a question session at the end of this group. So if you could just stay on until then that would be great. Thank you. Our next speaker is Kevin Messner with the Association of Home Appliance Manufacturers.

Kevin Messner: Thank you. Yes, Kevin Messner. I'm the Senior Vice President of Policy and Government Relations at the Association of Home Appliance Manufacturers. We represent floorcare portable and major appliance manufacturers. That's everything in your home. You can think of from vacuums to coffee makers to dishwashers, clothes washers, refrigerators, electric knives. Everything that’s in your home. Generally that is a durable product. We have about a two hundred billion dollar economic impact in the U.S. as an industry and about a million jobs and about $57 or so billion dollars in wages in the U.S. So it's an important segment of the country economically, but even more importantly to everyone's everyday life in the home right now, which were spending a lot of time in our home during the pandemic. The supply chain. we’re very supportive of this administration's efforts to strengthen the supply chain. The supply chain is, it’s crazy right now. I mean, you've got the pandemic we all know

about, you got Suez Canal, you've got ships off the shore in Long Beach, and now, we got semiconductors. I mean, it's really tough for manufacturers to build products. And we also have steel and aluminum shortages. So it just keeps building and as manufacturers and appliance manufacturers that see themselves as providing solutions it's really really hard. It's day-to-day fight. So our message is really more of an immediacy. There's a lot of good long-term solutions to this and were supportive of that and need to do that. But we're struggling to get by week by week month by month with these supply chain issues. Message number one is they (semiconductors) should not be reallocated from home appliances to any other industry for political reasons or anything else. Most appliances will have semiconductors in them and they are long life durable products; refrigerators can last 10, 20 years. And so they have to be able to be work with connected appliances that help with connectivity smart appliances energy efficiencies all of those things, but we are really seeing there are, we did a consumer survey, and people that are buying new appliances now are using them two and a half times more than they've used them in the past because people are just in home, in the home and you have you know, you're working at home you have kids in your home and the kitchen is the center of the home. What I always liked is where in the home is the most important though the priceless work of art. It's in the home. Where is it? It's hung on the refrigerator. That's where the most important art work is always displayed, it's on an appliance and it's just really important in everybody's life and they're using them more. And if you need an appliance to be able to cook your food, to store your food, and if it breaks you need a new one, you can't sit there and wait. Oh, sorry, I got to wait for a container to go back to China or I got to wait for a semiconductor because they were reallocated some other thing. You just put your food in a you know in a hole in the backyard try to keep it cold. No. Well they have to get their refrigerator now, they need to cook the food, you have to keep your house clean, you have to wash your clothes. You have people coming back from the hospital. And before they come into their families, they want to wash their clothes and clean themselves for their family and to take the time to spend time with their family. They have to shave their face so that the face mask properly seals, dish cleaning. So it's part of the clean sanitary home. It's part of cooking. Semiconductors are needed. You can't build an appliance and miss a part and if there's a semiconductor shortage that will lead to aggravating the backlogs that already exist to try to get an appliance right now. So there's a very important to our industry, appreciate you guys looking into this and trying to find solutions and doing the best we can but we have to keep the semiconductor supply as robust as we can in the U.S. and also internationally. We should also, we ask that you use the U.S. Department of Commerce in your consulates overseas to make sure that other countries are not putting political pressure on their semiconductor industries to reallocate for political reasons within their country as well because that that will have a huge impact here at home. I think I will actually just stop there and wait for questions and let you guys move on to others, but thank you for listening.

Moderator: Thank you so much, Kevin. Our next speaker will be Ed Brzytwa, with the American Chemistry Council.

Ed Brzytwa: On behalf of the American Chemistry Council and our nearly 160 members, thank you so much to BIS and the panel for the opportunity to speak today. It's an honor to be included on such a stellar speaker roster, even from an upstream perspective. I think we're probably the only upstream group speaking today. On Monday we submitted written comments to the Department of Commerce. But today my remarks will focus on three areas: first we intend to demonstrate the value of the

chemicals add both to the semiconductor manufacturing process, as well as the end products themselves. I will then highlight the role that globally integrated supply chains have played in enabling our industry to create the added value and support job creation. And finally, I will offer several suggestions for strengthening the competitiveness of the U.S. chemical industry, incentivizing greater investment in the United States, and minimizing potential risks within the supply chain. I will also note that our written comments touch on a number of ongoing regulatory issues concerning specific chemistries relevant to semiconductor manufacturing. I'm happy to discuss those in the QA. Clearly, it would be impossible to make semiconductors without chemicals. Many of our members have supplied important chemistries to the semiconductor industry since its inception. For example, electronic chemicals are essential not only to manufacturing semiconductors, but also printed circuit boards and other microelectronic devices. Related products like cleaners, developers, dopants, encapsulants, etchants, photoresists, specialty polymers, plating solutions, and strippers are all made possible by chemistry. And materials such as pipes, tubing, fittings, membranes, coatings and moldings, they also depend on chemistry. Importantly, a wide range of chemistries enable the production of silicon wafers. These wafers are essential to manufacturing semiconductors and therefore so are the chemistries on which those wafers' performance depend. I'll list a few: semiconductor substrates that derive from crystalline silica, atmospheric gases and specialty gases, fluoropolymers, photoresist and photoresist ancillaries, chemical mechanical planarization flurries and pads, and deposition dielectric and other electronic materials. In addition to playing a critical role in manufacturing of semiconductors, chemistry is a powerful job creator, an engine of economic growth for the semiconductor industry. For example, in 2019 U.S. business of chemistry supported 379,000 workers in semiconductor and electronic component industry. Our industry supported $44 billion dollars in payroll, and we supported $53.4 billion in value added in semiconductors. The semiconductor industry is not alone in benefiting from the job-creating power of chemistry. In fact, for every one job created by the business of chemistry, we create more than seven times as many jobs elsewhere in the economy, totaling over 4.4 million American jobs. The success of well integrated low-cost global supply chains has played a significant role in our industry's ability to grow and create jobs over the past two decades. We also recognize that certain risks can arise over time and those risks must be mitigated. In our view, the success of the semiconductor manufacturing process supply chain is first predicated on enhancing the competitiveness of the U.S. chemical industry, on which it depends. To strengthen the competitiveness of our industry, ACC encourages the administration to focus on six factors: 1) abundant sources of natural gas and Natural Gas Liquids, which are the primary feedstocks and energy sources for manufacturing chemicals in the United States, 2) low-cost imported intermediate inputs into manufacturing chemicals, 3) high skilled labor facilitated in part by immigration, 4) strong protection of intellectual property rights including trade secrets, 5) world-class ecosystem for R&D and innovation, and 6) high standard protections for human health and the environment.

Enabling greater chemical sector innovation and competitiveness might even require incentives from the United States and state governments, and these should be constructed in a way that does not distort trade and investment. Such incentives should include tax credits and abatements, expedited permitting for plant construction or upgrades, programs to educate the workforce in response to industry needs, facilitation high-skilled immigration, access to workers training and retraining programs, public-private partnerships for R&D of new materials and technologies, and potential cost shared grants

to support domestic capital investments for key upstream materials, including chemical inputs as well as infrastructure, and finally relief and an assurance for domestic supply chain disruptions caused by hurricanes, wildfires, and winter storms. Another straightforward way to incentivize U.S. production of semiconductor dependent chemicals is to provide tariff relief. ACC encourages the Department of Commerce to work with the office of the U.S. trade representative to identify the relevant intermediate inputs exposed to most favored nation customs duties, plus the additional tariffs under Section 301 of the Trade Act of 1974. ACC in our partners continue to call for quick Congressional renewal of the miscellaneous tariff bill, which may provide temporary suspension of reduction of the MFN duties imposed on imports of intermediate inputs. The MTB expired at the end of last year, unfortunately. It's also important that the U.S. strategy on supply chain resilience prioritizes the opening of new markets. Commercially meaningful new market access allows our companies to take advantage of economies of scale thereby manufacturing more important chemistries and at home in the U.S. and exporting more of those chemistries to the world. Enhancing our competitiveness will foster more competitiveness in the long run and therefore greater supply chain resiliency. And where U.S. trading partners are not playing by the rules or tilting the playing field in favor of their domestic companies, we'd urge the administration to enforce U.S. trade agreements and U.S. trade remedies laws. ACC is ready to serve as a source of information and experience regarding the role of the business of chemistry, enabling a more vibrant resilient and secure semiconductor manufacturing industry in the United States. Thank you for listening and I look forward to your questions.

Moderator: Thank you very much Ed. Our final speaker for today is Jeffrey Ferry with the Coalition for a Prosperous America.

Jeffrey Ferry: Hello, Erika. Thank you. Hello, my name is Jeff Ferry I'm Chief Economist with the Coalition for a Prosperous America. We are an advocacy group and think tank dedicated to broadly shared U.S. prosperity, stronger economic growth, and reduced inequality, which can only be achieved by rebuilding the U.S. manufacturing sector and encouraging the growth of high wage, high growth industries. Unusually for an economist I also have real-world business experience. I spent more than 16 years in the technology industry including six years at Infinera, an optical networking startup that built the only Greenfield chip fabs established in Silicon Valley this century. The U.S. is today facing a serious crisis in the semiconductor industry. As the current widespread chip shortage graphically illustrates, the U.S. has become overly dependent on a handful of chip manufacturing houses, known as fabs, primarily in Asia. Today, auto workers are being laid off because auto manufacturers cannot get the chips they need to build vehicles. The challenge the U.S. faces is threefold: first, China is targeting the chip industry as one of its made in China 2025 critical industries where it aims to become a world leader. Secondly, our global supply chains have become longer, more concentrated, and more fragile. Today, they are less resilient than they were a decade or two ago and more susceptible to disruption from unpredictable international events. Finally, the U.S. financial system is driving U.S. Chip design companies to sell off or shut down their manufacturing operations making us even more dependent on foreign chip fabs. This over-dependence on a small number of foreign fabs located far away and close to China is a danger to our economic security and our national security. The danger to national security is that virtually every military system, including even the humble Jeep, is today dependent on chips so that the nation that gains a lead in chip technology has the upper hand in every domain of modern warfare. Today, China is estimated to be spending $120 billion dollars of venture capital funding to catch up and surpass the

United States and other semiconductor powers. The steady loss of manufacturing capability in the U.S. will accelerate if we do nothing. Experience shows that design and product development tend to follow manufacturing, so if manufacturing continues to move to Asia, we can expect product design and R&D to follow it over time. The solution is for the U.S. Government to take a leadership role and target rebuilding our chip manufacturing capability. We recommend the U.S. set a target of 50% production capacity within the U.S. for every major segments of the semiconductor market. I mean by this the U.S. should have the capacity to supply the U.S. industry with 50% of the chips needed in logic semiconductors, 50% in memory, 50% in analog, 50% in power semiconductor, 50% in display semiconductor, and crucially 50% in artificial intelligence machine learning semiconductors. To achieve this the U.S. Government should establish a public-private partnership to build, own, and operate fabs within the U.S. This project could start with GlobalFoundries. The other partners in such a venture should be the major U.S. fab-less chip companies. This would give the fab-less chip companies an interest in steering their manufacturing work to the new U.S. based consortium. There are four crucial steps to making this process successful: first, the U.S. government should set a target objective, which we're suggesting should be 50% of the production capacity located here in the U.S. It should not just dispense money to chip makers and hope they do the right thing. You must know your objective. Secondly, the U.S. should extend the investment capital to make this target achievable. The $50 billion dollar figure in Chips for America is a good number; a total of a hundred billion dollars would be a better number, and remember there's a multiplier effect when you build a consortium because the other partners would invest alongside the federal government. Third, a new business needs customers. The customers for U.S. fabs are the U.S. fab-less chip makers. There must be incentives to get these customers to favor U.S. fabs. That is in our economic interest and our national security interest. Tax credits, a stake in the consortium, or if necessary tariffs could provide the right incentive to rebuild the U.S. fab industry. Fourth, U.S. fabs need protection from the predatory practices of foreign suppliers…

Moderator: Mr. Ferry, I think your sound went out. Mr. Ferry.

Jeffrey Ferry: …software firms from selling to Chinese chip makers. Finally, in a recent article published on the CPA website. We pointed out that leading U.S. chip makers last year returned $42 billion dollars to shareholders far, more than they invested in their own businesses. The U.S. public stock market system we have today favors short term management of the stock price and short-term enrichment by senior executives over long-term investments in national wealth. We need to fix this system. We can only remain the world's largest economy and the world's largest superpower if we find a way to incentivize companies not to manage their stock price on a weekly basis, but instead to invest in that company and the nation's future with a 20, 40, or 50 year time horizon. Thank you very much.

Moderator: Thank you Mr. Ferry and thank you to all our group three speakers. We are going to turn to the USG panel for a question and answer session. We are going to open it up to group 2 and 3 to answer if you are one of those 16 speakers and you would like to respond to one of the questions, please use the raise hand function and we will call on you. We will do our best to allow all those interested to speak while also considering our time constraints. USG panel?

Sahar Hafeez: This is Sahar again, I think I'll ask the first question and then hand it over to Monica. So my question is what are some of the workforce related challenges you face across the supply chain? We heard a lot about STEM issues and the immigration related issues which are, you know, obviously very

important, but was curious if you could take us through some of the manufacturing specific issues. So yeah, that's what we'd be interested in hearing. Monica, do you want to go ahead with your question then we can just have people to answer?

Monica Gorman: Yeah, thanks Sahar. So thanks everybody. It's been a really, really interesting afternoon. Several of you have spoken eloquently about the need for investment other things in domestic manufacturing and also the need to coordinate with allied countries. So I'm just curious, how would you rate the relative risk of semiconductor manufacturing and advanced packaging for domestic production versus production in allied countries versus production in China by U.S. or allied owned companies? Would really be interested to hear your assessment of that relative risk.

Moderator: So first, we'll go to Ann Wilson with the Motor & Equipment Manufacturers Association.

Ann Wilson: I wanted to weigh in on the issue of workers training and the importance of it. As I mentioned, we represent a thousand manufacturers. It is… [Inaudible]…has to talk to one of our CEOs who can't tell you about jobs difficulties currently, but at the same time this is an industry that is being challenged to change dramatically, more automated or electrified, and the workforce is going to change with it so, you know, even though we did not testify on this it is one of the key issues that we have along with many manufacturers to both strengthen our current workforce abilities, but it's also to train workforce for the future. And Monica as to your follow-up questions. I know our members are interested in was a global supply chain as well as the domestic supply chain, but with particular attention played to our allies as well as our own domestic abilities.

Moderator: Thank you. Next we'll go to Todd Barnum with Linton Crystal Technologies.

Todd Barnum: Let me unmute and I'll put the video back up. One of the things that I wanted to address was the workforce piece. We're small here in the U.S. and what we've seen is an aging workforce. The knowledge for growing the semiconductor ingots is that Phil Dembowski had said have to be so pure and these ingots have to be perfect because as soon as you make it as soon as you make an error, now you've got problems in the end chip that's been manufactured over and over and over and over and over but by a lot of the big foundries. So I've seen a lot of that information. That's it's already left the U.S. Most of that knowledge is over in Asia where a majority of this manufacturing happens. I'd like to see something that kind of helps us develop it back here. I've got some younger staff that I'm trying to build up that I'm trying to move ahead, but it's a difficult piece that we're seeing. So we do need kind of some investment even from the university side, we need that semiconductor to be strong so that people want to get into that field that, that's what our university students are looking to do. And right now I don't see that.

Moderator: Thank you. Next we'll go to Falan Yinug with SIA.

[Inaudible from 02:48:28 to 02:48:48]

Moderator: Falan with SIA are you there?

Falan Yinug: Yeah, can you hear me?

Moderator: Yes, do you want to respond to any of the questions?

Falan Yinug: Yes, it's really too bad that I think I want to underscore first of all, certainly the question of STEM education and domestic efforts to improve math and science education is critical for especially for long-term growth of the domestic workforce and capabilities and up leveling of the abilities of the domestic workforce to meet an expected increase in domestic activities for the industry. Second, I would definitely say that high-skilled immigration policy needs to better align with expected increase in demand for semiconductors workers domestically. I think it's critical. There's a shortage of skilled workers high-skilled workers in the United States for the semiconductor industry and there are skilled workers abroad who can meet that. One interesting component I'd like to also just underscore about the semiconductor industry in particular, you know, the profile of the semiconductor workforce, especially for manufacturing, is quite diverse. There are a number of jobs if you look at the BLS data in terms of the types of jobs that are needed for semiconductor manufacturing the vast majority of jobs actually are for semiconductor manufacturing technicians who don't necessarily need an advanced degree to participate in the semiconductor industry as a worker. So this is the industry, you know employs a wide variety and needs a wide variety of skilled workers with various levels of education. And so I think that should be very important to keep in mind.

Moderator: Thank you, and we're going to go to Matt Borman for another question.

Matt Borman: So we talked, heard a lot, from the speakers on almost every aspect of the supply chain, but I'm wondering if any of the panelists had any thoughts on particular incentives for advanced packaging which is our understanding is, would become more important as we get closer and closer to the end of Moore's Law, so if there are any thoughts people had on any incentives that may be particularly relevant to really spur the development of advanced packaging as part of the supply chain given that there's almost no packaging part of the supply chain currently in the United States. Thanks.

Moderator: Okay, we're going to go to Dr. Shamik Das. Dr. Das do you want to answer Matt's question? I saw your hand was raised.

Dr. Shamik Das: I apologize I had two mute buttons. Okay. Yes, I did. So thank you for that question. It's important as we get to the end of Moore's Law and start looking at what we call these Beyond CMOS technologies that we develop an ecosystem in the U.S. that lets us experiment and integrate those Technologies on a CMOS platform, on an advanced silicon platform, so that we can quickly prototype, test out ideas and develop new capabilities in the U.S. for exploring these kinds of technology. So there's a lot of good research out there, especially in the academic community on these kinds of emerging ideas. It is relatively difficult to get those into commercializable platform. And so creating that ecosystem where we can try those things out in a production environment would help enormously.

Moderator: Thank you. I do not see any more raise hands, does the USG panel have any additional questions? All right. I think we will wrap up our question and answer session. I'd like to thank the USG panel Matthew Borman, Sahar Hafeez, Monica Gorman, and Michele Schimpp for serving on the USG panel. I'd like to thank all of our speakers and attendees today and I'd like to turn it over to Matt and Sahar for some closing remarks.

Matthew Borman: I want to once again thank everybody for participating both those who spoke, also those who are listening, and as many speakers have said it's clear to us that for this issue we really need as much input and consultation with industry and the academic world as possible because this is such an

important and large issue. So we look forward to continuing to have engagement on this. I anticipate that once the initial report is done they'll certainly will be a lot of follow-up and certainly as we move to look to implement whatever funding comes out of appropriations comes out of the Chips Act, that'll be another very significant aspect of this. Sahar anything else?

Sahar Hafeez: No, I mean I just wanted to really thank you all for your time, this was really helpful. We learned a lot and will incorporate as we review the report, we'll incorporate the feedback here and we just really appreciate it. As you probably know President Biden is the car person, so, you know, that's been a big theme here today. We're very aware of the chip shortage and the difficulties there and I think that you know with the recent infrastructure proposals should be very helpful in terms of some of the challenges that were discussed today, and we look forward to the dialogue and really just thank you very much for your time. And I want to I if we were all together, we'd give her a huge round of applause to Erika, but let's just we will do a virtual applause to her for her tireless work at making this and making this a successful panel. Every time I went whenever Matt and I checked the time to see if we're like "oh wow, we're like exactly on track" and that's thanks to Erika and her bell, which I need to get now, but thank you again and have a good to have a good evening. We'll talk to you soon, bye.

Matthew Borman: All right. Thank you all.