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EMERGING TECHNOLOGIES AND NATIONAL SECURITY: POSTURING THE U.S. INTELLIGENCE COMMUNITY FOR SUCCESS

Wednesday, February 12, 2020

U.S. House of Representatives,

Permanent Select Committee on Intelligence,

Subcommittee of Strategic Technologies and Advanced Research,

Washington, D.C.

The subcommittee met, pursuant to call, at 10:01 a.m., in Room 2020, Rayburn House Office Building, the Hon. Jim Himes [chairman of the subcommittee] presiding.

Present: Representatives Schiff, Himes, Carson, Speier, Quigley, Swalwell, Castro, Heck, Maloney, and Krishnamoorthi.

Chairman Himes. The subcommittee will come to order.

Before we begin, I want to remind all of our members that we are in open session, and as such, we will discuss unclassified matters only.

Without objection, the chair may declare a recess at any time.

I welcome our members and our witnesses to today's hearing. I will recognize myself for a brief opening statement and then recognize the ranking member for any comments he wishes to make.

Let me start by saying that when our committee was created a year ago, we were handed a challenging responsibility, to focus on, oversee, and evaluate the Intelligence Community's development and use of emerging and advanced technologies. This challenge is as important to our safety and to our prosperity as it is historically resonant with those who remember the triumphs and failures of our recent history.

America got it right when we mobilized the best talent in the world behind the Manhattan Project to make sure that the forces of freedom and liberty developed nuclear technology before the fascists could. We got it wrong in 1957 when millions of Americans stood in their backyards and watched a Soviet satellite pass over their homes and communities time and time again.

Since then, a consistent technological edge has kept us safe and created a technology economy that our grandparents couldn't have dreamed of. Today, artificial intelligence, fifth generation wireless, quantum computing, and biosynthesis offer science fiction-like promise but also the possibility of game-changing, possibly existential threats. Will we lead in the development of these technologies, or will we be ambushed, Sputnik-like, by a cataclysmic technological surprise?

Measured by investment alone, our efforts are cause for concern. Federal funding

for R&D, research and development, as a percentage of gross domestic product has declined from over 2 percent in the 1970s to less than 1 percent in 2018. Meanwhile, competitors such as China have dramatically increased the amount they spend on research and development even as in China's case, they educate their people, recruit the world's scientists, and steal critical intellectual property.

As policymakers consider this challenge, we need to look beyond the dollars. Government is far more complex and bureaucratic than it was during the Manhattan Project. The private sector is now driving innovation in almost every sphere. The procurement process which links the two is famously challenging, time consuming, and generally offputting to private sector innovators.

Similarly, leveraging the brain power of American academics and scholars is a complicated bureaucratic endeavor. In order to harness the best innovative minds distributed throughout the U.S. economy, the government may need to make some changes to these processes.

Even keeping our most precious secrets, which used to simply involve putting a folder in a safe, is today much more challenging. To be sure, there are bright spots. The Defense Advanced Research Projects Agency and the Intelligence Advanced Research Projects Agency fill a critical gap between basic research and operational implementation for the Federal Government.

Similarly, the famed National Laboratories are treasures that leverage the benefits of the private sector, higher salaries and diverse customer sets, perhaps most notably, to aid Federal agencies in some of their most important research and development work.

Finally, winning isn't everything. We were fortunate to beat the fascist powers to nuclear weaponry, but the Soviets tested an atom bomb 4 years after the Manhattan Project. Crisper gene editing machines are everywhere today. The most powerful

artificial intelligence won't be a lot harder to copy, trade, or steal than any other software. In the long run, technological know-how spreads quickly. It is, therefore, critical that the United States double down on leading the world in the establishment of ethics and international norms that guide the way we think about and use these incredible technologies. While we may not be able to outspend or outman our competitors, we can and must do what we have always done, lead and work to create a better and safer world. I trust our witnesses today will help us to do that.

[The information follows:]

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Chairman Himes. With that, I recognize the ranking member, Mr. Stewart, for any opening statement he wishes to make.

As the subcommittee and the witnesses will note, Ranking Member Stewart and my Republican colleagues have chosen not to attend this hearing. You should know that I have asked at every step of this subcommittee's activities that Republicans be kept informed of every aspect of this subcommittee's work, invited to every meeting and codel. I invited them to offer witnesses, and in every case, I have been met with silence.

We received a letter this morning explaining the Republican absence from this hearing which is as wrongheaded as it is mendacious. It basically says that the Republicans disagree with the priorities of this subcommittee, something that the minority, of course, has never in this body, in any event, controlled and calling this hearing a publicity event.

I apologize to the witnesses for that. The Republicans had no objection to the formation of this subcommittee, nor did they ever raise the notion that staying ahead technologically was somehow unimportant.

Last week I asked Ranking Member Stewart what was going on. He told me that Ranking Member Nunes felt strongly that his Republican Members not engage in the public work of this committee because of some perceived grievance associated with the impeachment investigation, so this letter is actually a reversal of what I was told last week.

This is a sad and dangerous moment. Even as this committee was the epicenter of the polarizing impeachment debate, this committee has always succeeded in compartmentalizing the emotions and arguments of impeachment from the critical work we do on behalf of the American people. Not so today. That rubicon has been crossed.

This is a sad moment for me personally. I have spent a decade in this institution reaching out every day to my Republican colleagues even when the disagreements were furious. In my first term, a Republican group ran an ad against me that said I supported giving Viagra to sex offenders because I supported the Affordable Care Act, but I came to work the next day. Not a single soldier, CIA officer, or NSA analyst would dream of skipping work because they are angry that something that either President Trump or his critics said or did. They would be true to their oaths and to the idea of selfless duty.

Sadly, my Republican colleagues have made a different choice today, and it is there for all to see. I apologize to the witnesses. This never should have come to this pass. This is critical work. You have gone way out of your way to perform a selfless public duty, but we are going to make the best of it, learn, and do the work we were hired to do for the American people.

With that, I would like to thank all of our witnesses for their testimony today and introduce -- oh. Right. Honored to welcome our witnesses and distinguished panel.

Let me do a brief introduction here. Let me introduce the witnesses. We have got first Mr. Chris Darby, the Chief Executive Office of In-Q-Tel, and before that, the Vice President and General Manager at Intel.

Dr. DJ Patil, an advisor at Venrock and former U.S. Chief Data Scientist at the White House Office of Science and Technology Policy.

Next, Mr. Nick Sinai, a Senior Advisor at Insight Partners who was previously U.S. Deputy Chief Technology Officer.

And finally, Dr. Maria Zuber, the Vice President for Research and E.A. Griswold Professor of Geophysics at MIT.

Each of your statements will be made part of the record in its entirety. I would ask that you summarize your testimony in roughly 5 minutes, and then we will turn to

member questions.

Again, thank you very much for the immense efforts you have made and for your time today. And with that, I will recognize Mr. Darby.

STATEMENTS OF CHRIS DARBY, CHIEF EXECUTIVE OFFICER, IN-Q-TEL; DR. DJ PATIL, ADVISOR, VENROCK AND FORMER U.S. CHIEF DATA SCIENTIST, WHITE HOUSE OFFICE OF SCIENCE AND TECHNOLOGY POLICY; NICK SINAI, SENIOR ADVISOR, INSIGHT VENTURES AND FORMER U.S. DEPUTY CHIEF TECHNOLOGY OFFICER; AND DR. MARIA ZUBER, VICE PRESIDENT FOR RESEARCH, MASSACHUSETTS INSTITUTE FOR TECHNOLOGY AND MEMBER, NATIONAL SCIENCE BOARD

STATEMENT OF CHRIS DARBY

Mr. Darby. Thank you, Mr. Chairman, and members of the committee. It is an honor to be with you today.

My name is Chris Darby, and I manage In-Q-Tel, a not-for-profit strategic investor working on behalf of the United States Intelligence Community and the wider U.S. National Security Community.

In-Q-Tel's business is rooted in understanding the future of technology innovation, how market forces shape that trajectory, how these trends potentially impact U.S. national security, which emerging companies could provide these new capabilities, and ultimately how best to engage with those early stage companies.

In-Q-Tel has approximately 500 portfolio companies, and 78 percent of its portfolio have successfully piloted their technology to the point where it can be consumed by the Intelligence Community. Fifty-seven percent of those companies have ultimately been adopted by the Intelligence Community.

This said, In-Q-Tel is not a government procurement vehicle. We are a strategic investor. Having said that, I offer the following remarks in my personal capacity only. I am not speaking for the United States Intelligence Community, the U.S. Government,

In-Q-Tel, or the National Security Commission on Artificial Intelligence where I serve as a commissioner.

Thank you for inviting me to be with you today to discuss this fundamental issue of the next generation of technology and the role it will play in determining the future of the United States and how our government and private sector might effectively partner to support the Nation.

Historically, great power competition and global influence have often been won and lost based on a country's ability to achieve and project technical dominance. The industrial revolution provided the foundation for Europe's ascendency, and over the past 50 years, the IT revolution has underpinned the projection of America's strength around the world.

Names like Intel, Cisco, Oracle, Dell, Microsoft, Google, and many others emerged from Silicon Valley, Boston, Seattle, and the other innovation hubs around our country. These companies quickly grew to dominate the global markets, and in doing so, projected America's soft power around the world. Every country knew that the United States was the world's leader in high technology, and more importantly, they knew they benefitted from the United States' leadership.

I submit that over the next 50 years, the ongoing battle for technical supremacy will once again largely determine the winners and losers in great power competition. And more than that, this technology battle will likely determine the norms and values that will govern our lives. From where I sit, the United States appears to be at an inflection point. China is beginning to reap the benefits of a long-term strategy focused on leveraging technology to enable its commercial enterprise, advancing its power in international position without having to resort to military force. The U.S. needs to provide alternatives based on its own technology strategy and commercial enterprise.

Too often at the policy level, in the United States we view technology purely as an enabler of military capability. Technology, however, also projects economic power, it facilities societal stability or instability, and it reflects those norms and values. We must also acknowledge that today it is commercial technology that provides the underpinnings and foundations upon which Nations are built. That foundation is comprised of such things as communications networks, computing infrastructure, power grids as well as healthcare and financial systems.

The new great game is about dominance in these areas. It is interesting to note that a conversation took place 20 years ago -- 26 years ago, actually, early in Huawei's history between Ren Zhengfei who was the founder of Huawei and the Party Secretary General Jiang Zemin. In 1994, Ren suggested that the telco switching equipment technology was related to national security and that, I quote, a Nation did not have its own switch -- that does not have its own switching equipment was like one that lacked its own military.

This prompts the question: Are we today investing in the areas necessary to maintain a position of U.S. technical preeminence in the coming decades. I submit that we are making progress, but there are holes that need to be filled. Here in the United States, venture capital is a pattern recognition business, identifying opportunities that will, based on an investor's experience, deliver outside returns.

Today almost every pitch deck I see has the letters AI in it. That is not really instructive to know where these investments are going. The hot areas for investment remain things like cloud-based software services, machine learning-based automation and robotics, open source and premium models, and almost anything as a service.

The problem, though, is that this well-tuned pattern recognition business of American venture capitalists also means that patterns that aren't in their wheelhouse are

ignored, and some of these patterns are going to be critical to the United States' ability to project technology power over a long period of time. And therein, I think, lies the opportunity for the United States Government. We need to fill these gaps. We need to be able to syndicate private sector investment to forward our long-term national goals and strategies.

In closing, the battlefield over the next 50 years is going to be about the universities, the labs, and the startups that are innovating for the world. The investments in hard technology, including things like microelectronics, quantum computing, biotech must be made, and at the same time, we need to ensure that these significant research investments that we are making translate into the commercial enterprise and end up being a projection of America's power going forward.

I think that we need to start with a national strategy. We need a national technology strategy and implementation plan that is jointly crafted by the government and the private sector. What is needed is a common language. Startups don't speak government, and government doesn't speak start-up, but the conversation begins with a national technology plan that can be shared and discussed. And then what is needed are the incentives and measurements that align achieving the technology goals with the investments that we are making as a Nation.

Clearly, government will have to adapt as will the private sector. The status quo, however, will not work. The investment plan must be coordinated, in my opinion, across our R&D investments as well. We need to be able to look at where capital investment is neither being undertaken by the private sector or where such investment may serve to develop or encourage that entrepreneurship. It can form a syndication effect for the private equity ecosystem.

And lastly, I think that we must immediately invest and what I refer to as enabling

infrastructure. Investment in, for example, domestic microelectronics, merchant fab and fabrication, and packaging capacity to support things like the many powerful fabless semiconductor companies that are emerging here in the United States but are forced to go offshore to actually get fabrication runs.

We need to continue to work on our data assets to compete with China. And, obviously, the talent must be developed within our universities, and more broadly, within the educational systems in the United States.

So as the subcommittee considers how technology can contribute to the Nation's security and how to encourage a closer and more collaborative relationship between government and the technology firms, I encourage you to think expansively. I believe you can play a crucial role in helping the Nation understand the wider, less visible dimensions of geopolitical competition that I have outlined today.

We cannot wait another decade to organize a democratically inspired technology strategy to sustain U.S. global leadership into the 21st century.

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Chairman Himes. Thank you, Mr. Darby.

Dr. Patil, you are recognized.

STATEMENT OF DR. DJ PATIL

Mr. Patil. Chairman Himes, Ranking Member Stewart, members of the STARS subcommittee, thank you for this opportunity to testify on this important subject.

The success of our Intelligence Community is deeply personal to me. On September 11, 2001, I was conducting mathematical research, and after watching the tragedies at the Pentagon, the World Trade Center, and the field in Pennsylvania, I was determined to change my current trajectory in order to serve my country. Since then, I have served twice in public service, both in the G.W. Bush and Obama administrations including as the first U.S. Chief Data Scientist. I have also been an entrepreneur and investor in Silicon Valley, and I have helped establish the field of data science, including co-naming the field.

As the next phase of globalization develops, it is critical to make sure that the U.S. continues to preserve its competitive and national security advantage. The quote that I think sums it up best is from Ash Carter, the 25th Secretary of Defense. Security is like oxygen. If you have it, you don't pay attention to it. We have stopped paying attention to it.

To be blunt, we face a real risk of falling behind other countries, and let me use my limited time to highlight three areas of recommendations in my written testimony. First, we must begin closing the gap in our pace of innovation and enable the IC to leverage cutting edge technologies. We have fallen behind in certain critical areas before,

most notably in nuclear technology to Nazi Germany during World War II and in space technology to the Soviet Union with the launch of Sputnik in the 1950s.

But in both cases, we mobilized as a Nation, leapt ahead in basic research, and reestablished our leads more strongly than before. Key to that is our ability to attract, retain, and develop talent. Many of our Nobel Prize winners are immigrants, and so are the founders of many notable companies. Yet, the U.S. is seeing a decline in its ability to track highly educated immigrants.

And we are not utilizing American talent either. Minorities and women both remain underrepresented in STEM fields. Genius is evenly distributed, but to our detriment, opportunity is not. I must also point out that I am an immigrant. I am lucky to have been raised both in the foothills of Utah and later down the street from where Apple was founded. I am grateful for all the opportunities this country has provided, and it is why public service is so important to me. We must find ways to encourage the world's best to be part of this great country as well as serve.

Second. We must develop new models for collaboration. It is easy to believe the big data and the data science movement was started in Silicon Valley, but the true story is that many of us began our careers in national security. As U.S. Chief Data Scientist, I found that top technical talent and startups had a strong desire to work on national security problems, and they do today as well, but they don't have an easy way to contribute to the mission.

Under Secretary Carter's direction, we created a number of new programs to bring Silicon Valley and the Pentagon closer together including establishing the Defense Digital Service and the Defense Innovation Unit. The Intelligence Community, IC, should double down on these approaches and implement their own digital services and find new pathways to allow talent to come in as well as work more closely with startups.

Third. We must ensure that technology works for us and not against us, including the ethical use of data. The ethical challenges of data are not new. During World War II, the Nazis used data in early computers to identify and persecute Jews and people of Jewish ancestry. One of the notable stories is of Rene Carmille who ran the equivalent of the Census in France. He realized the Nazis wanted to use the Census data to round up French Jews. He then hacked the machine to prevent the data from being used. And when the Nazis discovered what this ethical hacker was doing, they arrested Rene and sent him to die in a concentration camp.

We need to get ahead of the potential ethical issues. The IC agencies and other Federal agencies should follow the recommendations in our book on ethics and data science, including what we call the 5C framework, the development of checklists to understand the management of algorithms and what can go wrong as well as red teaming to identify ways that technologies can be gained and utilized against us.

The ethical use of data is an active area of research, and the ICs and the Federal agencies will need to share best practices between the agencies as well as engage with industry and academia. There are significant challenges ahead to retain our cutting edge of innovation and ensure that technology does not cause harm. We are nascent in our understanding of newer AI techniques relative to the adoption, and there are serious questions about how we collect and use data, especially ensuring western values in that collection of data and utilization of techniques.

Finally, to ensure that technology works for us rather than against us, we must have more technologists in leadership roles and at the decision table alongside our current IC professionals.

Thank you again for this opportunity, and I look forward to engaging on this important topic.

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Chairman Himes. Thank you.

Mr. Sinai, you are recognized for 5 minutes.

STATEMENT OF NICK SINAI

Mr. Sinai. Chairman Himes, Ranking Member Stewart, and members of the STAR subcommittee, it is an honor to be here today.

I am passionate about today's topic of technology and innovation in government. In fact, I teach a class at Harvard called Tech and Innovation in Government. I have also seen what innovators and entrepreneurs inside of government can do firsthand.

I had the privilege of serving for 4 years in the White House, including 2 years as U.S. Deputy Chief Technology Officer. I have also seen tech innovation from a private sector career in venture capital. I currently serve as senior advisor to Insight Partners, a large venture capital and growth investing firm, headquartered in New York City.

At Insight, I work with portfolio companies to help them enter and grow in the public sector. Insight primarily invests in fast growing software companies. And as the saying goes, software eats world. When we talk about AI, data, cloud, or cyber, we are fundamentally talking about software innovation. How the IC builds, buys, and evolves software faster and better is a central question for the subcommittee. Every IC agency needs to be a software agency. Let me offer a few observations.

First, venture-backed software companies face substantial barriers to effectively serve IC customers. These include logistical, technical, financial, cultural, and contractual barriers. I work closely with experienced vice presidents in Federal, many of whom has been selling into the IC for decades, and some of whom served in uniform early in their

careers. In preparation for this testimony, I spoke with a dozen of them. All of their experiences, as well as my own direct experiences, have led me to conclude that there is simply too much friction between venture-backed companies and the IC.

The unfortunate result is that many venture-backed companies enter the IC years after they have successfully entered the Federal, civilian, and DOD markets. Let me put this another way. The IC is perpetually late in seeing innovative tech that is already validated in the marketplace. This fact should be unacceptable to the subcommittee.

Second. It is worth recognizing that getting access to next generation tech is not a new problem, and we can build on past progress. I am honored to testify with In-Q-Tel CEO Chris Darby today. In-Q-Tel helps fund product development and raises awareness in the IC for those companies it partners with. But there are limitations to the model, and only a few companies I work with have In-Q-Tel as a co-investor.

More recently, the Defense Innovation Unit, founded under former Secretary Ash Carter, was created to help the DOD access Silicon Valley style innovation. DIU matches internal defense customers with commercial technology companies aiming to deliver a contract in under 60 days. One thing that In-Q-Tel and DIU have in common is that they hire people from the startup and VC ecosystem, and they are physically located in markets like Boston, Silicon Valley, and Austin. If you want to find commercial innovation, it helps to physically be there. If you want to talk with entrepreneurs, it helps to hire people that speak their language.

Third. I want to highlight the problematic role of Federal systems integrators. These traditional beltway companies are incented to sell services like the custom development of IT systems rather than promote the adoption of commercial technology. These integrators also play a critical role in vetting and recommending new technology for the IC, a clear conflict of interest in my mind.

And finally, I want to raise the topic of security clearances. The security clearance process is a major impediment to the adoption of next generation technology.

I know the subcommittee is also interested in hearing potential solutions, so let me highlight a few ideas from my written testimony. First, we should create a centralized on ramp for commercial companies to sell into the IC. Imagine a new government unit to test commercial products, help NextGen vendors navigate IC clearance and acquisition issues, and connect those companies to funded IC programs and users.

Second, we should start an intelligence innovation board with a mandate similar to the defense innovation board. The DIB has offered a number of important recommendations about how DOD should reform how it builds, buys, and evolves software. At the very least, I would urge you to consider the DIB's existing software and IA recommendations for all IC agencies.

Finally, we should encourage more term limited tours of duty in the IC. My experience with the Presidential innovation fellows, U.S. Digital Service, and 18F have shown me that talented, mid career tech professionals want to serve their country. We should also find ways for more IC professionals to do tours of duty in large tech startups and even VC firms. The IC is only as strong as its people, and getting the best of America to serve will help us all. Thank you, and I look forward to your questions.

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Chairman Himes. Thank you, Mr. Sinai.

And finally, Dr. Zuber, you are recognized for 5 minutes.

STATEMENT OF DR. MARIA ZUBER

Ms. Zuber. Great. Thank you.

Chairman Himes, Ranking Member Stewart, and members of the committee, thanks for inviting me to testify on this critical subject, how to ensure that the Intelligence Community has the technology it needs to protect our country. One way to frame that issue is to ask how can the U.S. maintain and build on its current strengths to help the IC.

I believe those strengths include world class universities and open research system and the ability to attract and retain top talent from around the world. The Federal Government can do more to strengthen these assets and ensure that the IC is benefitting from them.

My recommendations fall into three categories: Enhancing U.S. research in key technology areas, improving interactions between the IC and our research system, and ensuring that the U.S. remains a magnet for top talent.

First, research. Keeping the U.S. ahead in critical technologies like artificial intelligence and quantum computing requires strategy and funding. The Federal Government needs a visible, focused, and sustained effort in key research areas. That would entail a significant increase in funding for fundamental research at universities targeted at problems like developing new algorithms that would enable machines to learn with less data. That increase should not come at the expense of the rest of the research system. Ideally, it would be paired with reforms to improve focus across agencies.

One way to turbocharge existing efforts would be to create a new directorate at the National Science Foundation with DARPA-like authorities that would focus on critical technologies. The directorate could provide funding to other agencies as well as to universities and consortia involving industry.

Second, more interaction with the IC. The technologies needed to defend the U.S. increasingly originate in the civilian sector. The IC needs to be better positioned to help shape research questions in academia and industry and to capitalize on research results. That requires greater collaboration. For example, IARPA could enhance interaction with agencies like NSF and NIH and vice versa to think about how open research could advance the IC's goals. The IC, on its own or in collaboration with other agencies, could run more challenges in key areas as DARPA does. And the IC could do more to rotate members through universities and Federal labs. There is no substitute for having people work side by side. This can and must be done without damaging the open culture of universities.

Last year, MIT signed a 5-year agreement with the Air Force to operate what we are calling an AI accelerator. Under this program, Air Force staff are working both on campus where research is open and at Lincoln Laboratory which MIT runs and which is secure on problems of interest to both the Air Force and to MIT. It is a model the IC could deploy.

Let me add that such cooperation is especially appropriate to help sort through the ethical questions posed by AI and other new technologies. Those research questions require attention not only from experts in the social sciences and humanities but also from technical experts who are working together, for example, on minimizing bias in AI algorithms.

Third, talent. The U.S. will not succeed if we alienate or turn away ambitious, brilliant students and researchers. Obviously those who are coming into our country

need to be thoroughly vetted, but that process needs to be targeted and rational. It cannot appear to be harassment. The latest statistics from the National Science Board shows that foreign students account for more than half of U.S. doctoral degrees in engineering, mathematics, and computer science with more than half of those foreign students coming from China, India, and South Korea. This is not a new situation. What is new is that fewer of them are staying, although most still remain. NSF found that 84 percent of the doctoral students from China were still in the U.S. 5 years after receiving their degrees. We need to get more U.S. born students into STEM fields, but even when we succeed at that, attracting and retaining top international students will still be an asset.

As the Federal Government and universities rightly shore up our systems to prevent improper and illicit losses of technology, we need to be sure that we take actions that address the actual problems. Foreign students have not featured prominently in cases of technological theft, yet they are frequently the target of restrictive proposals. New policy should be focused on real security gaps, not on classes of people who help the U.S. but are easy to demonize or restrict.

The U.S. faces new challenges and competitors, but we are well placed to succeed if we get the most from our unrivaled strengths. The heart of our strategy must be confidence in ourselves, not fear of others.

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Chairman Himes. Thank you, Dr. Zuber.

We will now proceed with member questions, and I will start by recognizing myself for 5 minutes.

Mr. Darby, your testimony and our conversations, you are really interested in this question of microelectronics and the lack of capacity the United States has in such a critical area. We see this come up a lot in 5G technology where the United States doesn't have a private sector champion to compete with Huawei in particular.

My question for you is it is culturally odd for the United States to think about an industrial policy where we invest in specific companies and subsidize others.

I know it is a long question, but in a couple of minutes, what is the way we could achieve what you want to achieve with respect to microelectronics, kind of consistent with the idea that we don't have an industrial policy in this country.

Mr. Darby. Thank you, Mr. Chairman. I think it is important to start and maybe back up and look at the way In-Q-Tel works because it is a very unique model with obviously a lot of misconceptions around what we do and we don't do. It is really a combination, a very unique combination of private sector expertise on the technology side, the investing side, and the start-up side, but it starts with an exploration function.

It really starts with trying to understand where technology is going over a long period of time. And so we will vet literally thousands of companies every year. We will meet with in the order of a thousand companies every year and then winnow it down to those companies we think over a period of time will impact the national interest, the national security interest.

In the case of microelectronics, for example, for a long time, we have been looking at companies that were going to deliver the next generation of microelectronic

innovation beyond general processing units, GPUs. As we move into an era of AI, the differentiation of AI plus hypersonics means microprocessors are going to mean an awful lot.

And so we have got a very rich history in this country of building these small companies that build those next generation intel types of scenarios, but we are forcing them right now to go offshore.

And so what we do as In-Q-Tel is we say what are the different elements that you would need to create a capacity here in the United States? Do we have the tools that are necessary to get this next generation of microprocessing companies off the ground.

And when I meet with our portfolio, and it is a fairly rich portfolio in that sector, they would say no, we don't have the tools. We have to develop them ourselves. We don't have the packaging facilities here in the United States. We don't have fabrication access, the merchant fab capacity.

And so in areas like that, In-Q-Tel looks at the horizon and says what are we going to need? For example, 12 years ago, our team brought me to a little office in San Francisco, and DJ will probably resonate -- this will resonate with him. There were three guys in front of a screen.

One guy was named Jack, and the screen all of a sudden popped up with 140 characters, and it said I just had asparagus for lunch. And I looked at the investment team member that brought me to this meeting, and I said why am I here? This does not make any sense to me at all, like you are wasting my time. Well, he said no, you are just old. This is going to be important.

This social media platform is going to be very meaningful to our community in 7 or 8 years. We need to invest not in this company called Twitter, we need to invest in all the analytic engines that make us understand what is going on in Twitter.

And so if you look at the value proposition of In-Q-Tel, what we do is we see things well beyond when our customers see them because we are engaging with these embryonic startups. By the time the company has a fed VP of sales, that is not our target market at all. When we engage in these companies, they don't even have a sales vice president. They are thinking about how they want to bring their product to market, where they want to go in the government, or do they have a fit in the government.

Chairman Himes. Let me just cut you off, Mr. Darby. I think that is a really important answer. It is one I will want to pursue because you are essentially sort of adopting the mantle, perhaps, via In-Q-Tel of maybe taking the lead on some of these technologies, but we will come back to that. I want to be disciplined so other members have a chance.

Mr. Sinai, very quickly, this is a big topic of conversation. I just want to plant the seed with you. You have a very frank critique of the role of Federal systems integrators here that I think is really important, and you point out how the sort of incentives there create an incentive to maybe ignore innovation.

So I don't have time left, but in the second round, I am going to ask you what the alternative is. In this building, we can shake our fists at corporations and Federal systems integrators, but they are going to act according to the incentives that drive them.

And so my question for the second round for you will be how can we maybe restructure that set of incentives so that the big players are, in fact, contributing to innovation and adopting innovation. Thank you.

I will recognize Mr. Carson for 5 minutes.

Mr. Carson. Thank you, Chairman.

Is there any way in which the United States is at an inherent disadvantage in the race to develop AI? For example, Chinese operatives were just indicted by the Justice

Department for the Equifax hack. These operatives do not operate by the same democratic principles we do, so there are fewer restrictions on the scope of their collection, but we also know that the effectiveness of an algorithm or AI in general is highly dependent on data sets that it has as a repository or database.

Does the wider scope allowed by the Chinese Government to even gather massive amounts of data without the precondition of protecting privacy put them at an inherent disadvantage, and should the United States perhaps look at an AI czar?

Ms. Zuber. I will start out with that. So there is no question that the Chinese have larger data sets at their disposal, and it is actually why some U.S. companies and entities want to collaborate with the Chinese to access some of those data sets. In any of our interactions, you know, we will obey U.S. privacy laws, and the question is finding the right balance of where those ought to be.

A critical aspect of any interaction that we have on the world stage is to try to encourage all countries to come up to international standards with regard to data privacy and data sets. And so we will not allow any of our investigators at MIT to do collaborations unless there is reciprocity in terms of what data can be shared and what the privacy considerations are.

Mr. Patil. And let me take this from a slightly different angle because I very much agree with all of those points. The first is in the collection -- to make an algorithm effective with AI, one of the key things and tenets is to have large data sets.

So in the case and the ability where you don't have restrictions and the ability to just vacuum up data arbitrarily gives you a disproportionate advantage in getting going.

One of the areas that we don't often think about is we think about in terms of genomic medicine and biomedical research. And the area that is there and that we are predominantly concerned about in the development of large programs that we had in the

Obama administration called Precision Medicine Initiative under 21st Century CURES Act is how do you safeguard that on the U.S. side.

And what others are looking at is how can I combine that data to jump forward to actually displace the traditional industry structure that we have right now that is built on western values.

The ethical implications of that are very serious, and we have seen that in the past here in the United States both with Tuskegee, Henrietta Lacks, and many others. And so this is actually a fight for values around data.

Mr. Carson. So how can the Intelligence Community foster greater exchanges of talent with academia and industry to Dr. Zuber's point?

Ms. Zuber. So I will start there. Well, the security issue that was raised was something that I also talked about in my testimony. So right now, the time to get a security clearance is long, and it is getting longer, but a lot of the work that goes on within the Intelligence Community isn't actually classified.

So getting somebody, you know, at the first level, you know, some nominal level of clearance and letting them go in to try to understand, to work on unclassified problems is a great way to start while they are in the process of getting cleared.

Mr. Carson. Sure.

Ms. Zuber. There should also be -- the exchanges should be two ways. I mean, we welcome on campus and at Lincoln Lab members of the DOD to do rotations through labs, both classified or unclassified, and those could easily be expanded to the Intelligence Community because, you know, getting to know people and understanding different cultures goes a long way to effective data exchange.

Mr. Darby. I would like to commend CIA. I believe that they put forth a proposal to amend the Central Intelligence Agency Act to focus more on education and

steam-based education programs, and I believe that is with the committee at this point.

Mr. Carson. Thank you.

Chairman Himes. Mr. Quigley, 5 minutes.

Mr. Quigley. Thank you. Thank you all for being here. I enjoyed the brief times I had teaching at universities. Doctor, I do appreciate what it means to bring foreign students here, not just what they contribute but how it helps us build democracies elsewhere and export our values.

But Mr. Darby, you also mentioned just how critical a role the universities will play. And I recognize that we don't want to blame foreign students for this, but given the value of this and the extraordinary value of information brought together there, you must appreciate the risks that are involved, the security risks that are involved due in part to that which we love, the open culture of universities, that mindset that is ingrained in professors who want to share information, but some of that has its risk as well, if you could comment.

Mr. Darby. So like DJ, I am an immigrant to the country, and I am grateful every day for the opportunities that this country has given me. Only this country could have given me the opportunities that I have been fortunate enough to have. Your point is well taken. There are risks. I think that we have to understand that there are risks. There is a phrase that is used in the IC often which is trust but verify.

I think if we programmatically look at the verification process of who are these individuals, the notion of identity intelligence and understanding where a person comes from and where a person's loyalties lie, I think those are reasonable questions for us to ask.

That said, I agree with Dr. Zuber. I think that the very nature of this country has always been welcoming, and it has been a foundation certainly for the tech industry in

the United States and the venture capital industry, and so I think we do have to find that balance where we trust but verify. And it is the verification process that I think we need to think about.

Mr. Quigley. Mr. Sinai?

Mr. Sinai. I am not an expert in this particular area. I will say that to me, the passion that the students that I teach and their desire to serve in government is infectious. That is one of the reasons that I teach, and so I am honored to help shape the next generation. I think that we need to continue to put great talent into Federal service.

So one of my -- a few of my students actually helped start an organization called Coding it Forward. So they came to me and they said, you know, we did our last summer at Uber Engineering, and we want to go work in the Federal Government, but we can't find any good roles. And being entrepreneurial students, they created an organization called Coding it Forward.

And now this year, there will be 80 technical students in Federal, civilian, and even DOD. It is really impressive to see how these students want to serve, and so we have to think about how we can create more on ramps for early career as well as mid career, and I think some of that can help here.

Mr. Quigley. If either of you doctors want to talk a little bit about how to make sure we are also protecting given the desire --

Ms. Zuber. Yeah. So thanks for asking this question. You won't believe how much of my life I spent thinking about this topic right now. So I think the key is we want to leave universities open, but we need to have a place where we can transition a technology.

So when a technology is advancing to the point where there can be either an economic or a technological threat, we should classify it, okay. So MIT does that. We

send it out to Lincoln Laboratory and it becomes classified, and then nobody on campus can see it. And it gets worked on by U.S. citizens with security clearances out at Lincoln.

The key is to make, I will say, a focused decision on what those technologies are. You can't just say AI, all right. But there are technologies, there are definitions of technologies, and actually the DOE national labs I think have been out in front in trying to make lists of technologies and what their level of threat is.

So the idea is, you know, if it is on campus, leave it open. If it is starting to be worrisome with regard to national interests, then classify it. But having a campus where certain students get access to kinds of information and other students don't will create a multi-tiered system where, you know, some students will feel like second-class citizens, and that is the day that we stop attracting talent from the best places.

Chairman Himes. Mr. Swalwell, 5 minutes.

Mr. Swalwell. Thank you. I thank our subcommittee chair for holding this meeting and our chairman for supporting it.

Just kind of following up on Dr. Zuber's point about our national labs. I have Lawrence Livermore National Laboratory in my congressional district as well as Sandia and always just marvel at the role they play in the Intelligence Community but just protecting us in ways that people don't necessarily think about.

I want to thank my colleague, Sean Patrick Maloney. He visited my district 2 weeks ago, you know, to understand that role, and our committee has been working with the labs. And I was wondering, Dr. Patil. I know that you worked at Los Alamos. And do you believe we are optimizing the role that the national labs can play in taking on some of the bigger challenges when it comes to research and development? And if we are not, what do you think we can do?

Mr. Patil. Thank you for asking that question. The national labs are very close

personally to my heart, largely because I started my training there and I got to not only experience the culture of what a national lab brings but the talent it attracts. And that was critical for me in the formation of many of the ideas that then became the ideas behind data science.

That melting pot was critical. And there was buildings that was outside the fence, outside the security environment that allowed certain collaborations to happen. There was a set of activities that happened inside the fence where there were -- they had the appropriate restrictions and controls.

The thing that I think we have done to the national labs is we have continued to erode and pressure the system in a way that is asking it to do things that it was not designed to, and we have been fundamentally unfair in evaluating it, looking for short-term gains versus the long-term value.

You know, if you think about the number of patents each year, it is about 1,500 every year, or sorry, 700 patents each year, about 1,500 innovations, and the amount of collaboration that is spun out is phenomenal. And the part there that I think we need to do is to reinvigorate the national labs, to encourage the national labs not only to foster additional collaborations that they do with each other but around moonshots as we saw that was happening around things like precision medicine or the Cancer Moonshot and find new pathways for those organizations as national labs stay engaged with industry.

Those pathways have been effectively shut down by budgetary pressure. I would love to see those opened up. I would love to see the exchange of people from traditional startups or larger tech companies, doesn't have to be just Silicon Valley. It can be Silicon Slope, Silicon Alley, Silicon --

Mr. Swalwell. Prairie.

Mr. Patil. Prairie. You know, all of it. I used Silicon Valley as a broad base. And if

we do that, I think we are going to see a different ramp. We forget that large scale distributed computing was invented at the national labs. That is where the Beowulf Architecture came from and so much more.

Mr. Swalwell. Great. Well, thank you, and I do agree. I am also working to change the way that they are treated by the Federal Government. As you know, many are government-owned, contractor-operated which means that some of the newer benefits that the Federal Government offers, whether it is student loan debt relief or because of the leadership on this committee, paid parental leave, you know, lab employees don't get that because of that contractor scheme. But they view themselves as Federal employees, and they are serving a Federal mission.

So I think in recruiting

and retention, it is important that we offer them that.

Mr. Sinai, you talked about security clearance reform. That is a priority for members on this committee. What are some of your ideas on how we can do that without jeopardizing national security?

Mr. Sinai. So I am not an expert in the actual process, but let me give you just a little bit of context about why it is so problematic. And I appreciate, Congressman, the investigation into possible reforms that the subcommittee may take. It is really challenging for companies to have that interaction with the Intelligence Community to talk about use cases of technology.

And there is great examples when the IC wants a particular technology, it goes and finds it, and you have great mechanisms like In-Q-Tel. But for a lot of innovations, it is challenging for those companies to have those repeated engagements where they are brainstorming, collaborating. It is a whole process, and it is hard to get on site. It is hard to do demonstrations. It is hard to hire the people necessary to engage with the IC.

And so it requires companies to hire cleared individuals to sell back into the agency and to do the sales engineering and collaboration. And so that adds to the expense and the challenge, and that leads to my -- those are part of the frictions of why it is so challenging to engage the IC from a venture-backed community.

Mr. Swalwell. Great. I thank the panel, and I yield back.

Chairman Himes. Thank you, Mr. Swalwell.

Did we lose Mr. Krishnamoorthi? If so, we are on to Mr. Heck, recognized for 5 minutes.

Mr. Heck. Thank you, Mr. Chairman. If there were an Exhibit A on why it is that those of us on this side of the dais are privileged to serve in Congress, it would be today's hearing and the opportunity to hear this interesting and provocative and important conversation.

And I thank each and every one of you for your presence and the time invested to come forward and your past public service.

I want to ask you each the same question. We hear a lot about the challenge of being able to compete with the private sector for top talent. And over the years I have been here, I hear a whole lot of ideas about what it is that we need to do in the IC in order to be able to compete for that talent and get some young 22-year-old code writer who could go help be a part of developing a food delivery app and make a zillion dollars, as it were. Not a theoretical example.

And so what I want to ask each of you -- and I realize it is a little bit challenging, but I want to ask each of you to give the two most important things that we can do to assure that we have optimized our opportunity to bring the best and the brightest into efforts in the technical field relating to IC. And I am going to further ask each of you not to attach more than, like, one sentence to each of the two bullet points.

What are the most important things that we can do because we have heard a hundred things. What are the two most important things we can do? And Dr. Zuber, if you would start, please, I would appreciate it very much.

Ms. Zuber. Okay. Thank you for your comments. First of all, you could incentivize with fellowships, particularly graduate fellowships for U.S. citizens in the STEM fields. That would be great.

And then the second is just any steps that could be taken to increase the interactions as we are talking about between national lab -- between Intelligence Community labs and university so that students understand better what the opportunities are. There is a lot of patriotic, very young, and smart people.

Mr. Patil. So very briefly, it is about alignment of mission with skills to enable impact. When you --

Mr. Heck. I have no idea what you just said.

Mr. Patil. Let me explain. When we were recruiting to bring in people from the technical companies into government, as long as we found the ability internally of an organization to align the mission with their skills so that they could have impact, we only lost two candidates, in my recollection, of ever recruiting.

And the time we lost those two candidates was because they had so much equity locked in the company, they couldn't leave. But it takes very serious effort to align the mission and the skills to actually be impactful.

The second is enabling what titles actually are. We spent nearly 5 years at the CIA creating the title data scientist versus statistician. That may seem trivial, but people allowing to have parity allows them to feel that they are still moving forward in their careers. In the same way as a chief data scientist, we created that as a job title across the Federal Government. We need more of those parities so people can move back and forth

seamlessly.

Mr. Heck. Okay, Chris. We are slipping on the one-sentence deal here, and I want to make sure --

Mr. Darby. I will do my best, Congressman Heck. We need H.R. reform. To DJ's point, things like titles count. In the private sector, you have VPs that are 25 years old, and yet, we have an expectation in government that you have to put in your 25 and 30 years before you are an SIS or an SES and so on and so forth. I think we need to create an environment that younger people can have a different career path and trajectory.

I think the second thing, and I am trying to keep this to one sentence, would be make it easy to go in and out. We have to decrease the friction associated with moving in and out of government. You should be able to go to the private sector for a few years, come back to government for a few years, and go back and forth in a seamless way. I know that is non-trivial, but I think it would mean a lot.

RPTR PANGBURN

EDTR HUMKE

[11:00 a.m.].

Mr. Sinai. I couldn't agree more. It is a great question, Congressman, and I just want to echo those comments that people flow -- how to get people in and out of government in rapid timeframes, not several year timeframes is critical. Candidates want to work for a mission they believe in, opportunity for impact, modern environment. They want to work on a modern technology stack. They want professional development. They want alumni network.

My experience with the presidential innovation fellows, the U.S. Digital Service, and GSA's 18F, this can be done. It just requires the kind of hiring reform and focus and I am excited that you guys are interested in this.

Mr. Heck. Thank you.

Mr. Himes. Mr. Maloney, 5 minutes.

Mr. Maloney. Well, thank you all for being here. I am struck by, well, many things you guys said, but particularly the culture issues between the public sector, Washington, and, say, Silicon Valley. So I was out there recently as my colleague Mr. Swalwell noted, had dinner with your colleague, Steve Boucher, big fan of In-Q-Tel and the labs are extraordinary. One of the things you hear over and over, again, particularly from, say, the FBI or the people who are charged with intersecting with Silicon Valleys, is that, Elvis Chun, who many of you may know who is the senior FBI deputy assistant special agent in charge, I think, who really is point of contact in many companies, told me -- I don't think he will mind me repeating it -- you know, you may think you are still in your country, but you are not. You have entered their country. You are no longer in your country.

So deep is the cultural divide and so the issue of how do we get those two cultures

aligned for the purpose of U.S. national security, I think, has been really cast and relief in situations like the 2016 election where we have -- and to this day, many of us have enormous frustrations around the attitudes and the approach taken by companies with a major role to play like Facebook and Twitter.

And I sort of wore out my welcome while I was there asking some of these questions, so really I am interested -- and maybe this question is best directed to Mr. Patil. Dr. Patil, how can we close that gap and is it really a barrier between the kind of information sharing and the kind of integration and on-ramping that Dr. Sinai spoke about, because it seems to be?

It seems to me there is an enormous barrier between the attitudes and the goals of people who work in the public sector, particularly in Washington, but even our representatives there and the private sector entities who we cannot do this mission without. How do we close that gap?

Mr. Patil. I am glad, first, that you went to engage because that is the first step. As we saw Secretary of Defense Ash Carter was the first Secretary of Defense to visit in over 20 years, Silicon Valley, and so we just haven't found ways to spend time together. And when we do spend time together and we are working on problems, often times it is under incredibly harsh light or questions around encryption and it forces the communities to look at each other very adversarially rather than actually creating forums where collaboration can happen.

The second part is, we actually don't have technologists who are coming in and out of government into those organizations and vice versa. And so we have issues of suits versus hoodies versus suits and hoodies. And there is a cultural element of how do we talk, how do we interact, and we need to create more of those forums.

Simultaneously, we need the companies and the executives there as well as just

the rank and file to begin to more deeply understand the challenges at a national/international level. And there is --

Mr. Maloney. But can you be specific about that? How does that work? As someone who used to manage software engineers, there is a certain type of learning -- you know what I am talking about.

And it can be very difficult to extrapolate sometimes concepts like being an American company and having a duty to the United States as opposed to being a global community that yada, yada when it is an issue of our national security that doesn't translate sometimes.

Is there something inherent about -- can you just dig into that a little bit? You know what I am asking?

Mr. Patil. Absolutely. So very specifically, you know, there is small things such as having executives go out with the military on an aircraft carrier, having people actually visit an intelligence facility and understand there.

People who experience and spend time with members of the U.S. digital service who are actually been working in Afghanistan and Iraq. Those activities help people see and feel viscerally what is at stake. And they may seem small and trivial, but they have -- every time I have seen an executive who has gone on that, and we have seen that with the defense innovation board, is a complete turn around in approach once they actually see and they meet a member in service.

Most Silicon Valley people, even if it is Silicon Valley, Moffett Field, which was the primary institution there, people don't interact with the military any more. The chances that a software engineer knows somebody in the military is near zero, and so we don't even have that experience any more.

Mr. Maloney. Did you want to say something, Mr. Darby? I only have 10 seconds,

but --

Mr. Darby. A lot of it is trust. A lot of it is continuity and trust. The 2-year rotational cycle in jobs makes it very challenging to build relationships, and so I think one of the benefits --

Mr. Heck. Tell us about it.

Mr. Darby. One of the things about In-Q-Tel, as you know, Congressman, we have been around for 20 years. I have been in this job for 14 years and so the trust relationships -- I can go and represent the Government's interests and they believe me largely because I have been part of that community for so long and I think it is a really important thing that we have to work on, continuity of relationship.

Mr. Maloney. Yield back. Thank you.

Mr. Himes. Mr. Krishnamoorthi, 5 minutes.

Mr. Krishnamoorthi. Hey, thank you so much for coming in today. You know, you mentioned immigration, Dr. Patil. I am actually an immigrant as well. You also mentioned having technologists in leadership roles. I am one of the few people in Congress, one of eight total, with an engineering degree. I have a BS in mechanical engineering. Some people say I practice the BS part now, but the point is that we do need more technologists in government.

I would like to ask the question about, you know, Chris, who is doing this right? Is there a government out there that has actually figured out the right way of having an ecosystem where government and the private sector collaborate, but not too much? I am wondering if Israel might be a model or if there is some other countries out there that we should know about?

Mr. Darby. I think Israel is a model, although, there is a fusion in Israel that we don't have and the extreme, of course, is the Chinese sieve mill fusion strategy between

their private sector and their public sector and where you can barely tell the difference as this committee knows.

And Israel, it is not as overt, but clearly there is very strong connective tissue between their military interests and their commercial interests and their venture capital interests. It is woven together. We don't have the benefit of such a small enclosed group to deal with. I think it is much more challenging here in the United States, and I gave a talk at NATO about a year ago to -- and every one of the countries that came up to me afterwards were saying they were suffering from the same challenges that we are suffering.

So if it makes us feel any better, I don't think we are alone in trying to address these issues.

Mr. Krishnamoorthi. Is there one thing that Israel does that maybe we can borrow from?

Mr. Darby. I think they have a path of technology out of their military environments into the commercial sector that is very, very well tuned. And ours isn't. I worry sometimes that we aren't taking advantage of the core research that we do in government whether it is in the labs and really working on a commercialization path for that.

The Israelis are great at that, and I commend Dr. Peter Heineman at DARPA who is really leaning into how do we commercialize and make the most out of the investments that we are making at DARPA and potentially there is opportunities at the labs to do the same thing.

Mr. Krishnamoorthi. Sure. Dr. Patil?

Mr. Patil. I will add one there, which is one of our recommendations I put in the written testimony as well as in our council foreign relation report recently about creating

a digital ROTC.

The Israeli's Defense Force has a division that is well-known, the 8200, which is you are recruited quite young and it is phenomenal talent and pretty much everyone knows in Silicon Valley over any technology company that that is a guaranteed certified fantastic technologist and that is one of those kind of elements that is -- that builds the trust model that establishes quality and allows people to go back and forth as well.

Mr. Krishnamoorthi. Sure. I was going to direct the next question to you, Dr. Sinai. Mr. Sinai?

Mr. Sinai. Doctor's my father.

Mr. Krishnamoorthi. Oh, okay. Mr. Sinai, you know, before coming here, I ran a very small company. We make and sell infared night vision technology for military and space applications. What we found is in the countries that dominate the sensors world are going to have a leg up on us with regard to, you know, our intelligence gathering capabilities. I was just wondering if you could comment on that?

Mr. Sinai. Yeah, I think that is absolutely true that there are certain segments to Chris's testimony. There is certain sectors that American VC don't focus on and so that should be an important focus of this subcommittee, right.

And so sensors is one of those areas where there are some really interesting investments that venture makes, but there is also a whole subset that they don't. The other point that I would make quickly is that we are also seeing the rise of next generation defense tech; that is, venture capitalists investing in the next generation of product companies.

It is important to realize that venture capital invests in products that can be repeatedly sold, and so we are seeing some really interesting companies that are targeted in the national security and defense space.

Mr. Krishnamoorthi. Dr. Zuber?

Ms. Zuber. Can I just add an example? So in the sensor area, making sure that we are fencing off the right technologies is critical, so infared cameras are in that category because of the night vision issue. However, if you are an international student in an academic lab in the U.S., you can get access to those; whereas, if you went to Europe, you can buy one off the shelf.

So we have some rules in our country in terms of what is restricted that could take some freshening up, so to speak, so that we are fencing off the right things so that we can get access to those technologies and then have smart people working on them so that we can spin them out.

Mr. Krishnamoorthi. I am out of time, but thank you, again, for coming.

Mr. Himes. Mr. Castro, 5 minutes.

Mr. Castro. Thank you, Chairman. First, and I think Denny Heck alluded to this, but we have spoken about the lack of workers, the lack of entrepreneurs in the United States, and the fact that we could do a better job, but the fact is, the high tech industry, Silicon Valley, and many of our States and the Federal Government underutilized a lot of different populations.

Women and coding and high tech and computer science, minorities in computer science and coding, so I would just ask you all as you go forward in your own roles to be mindful of how you tap that potential that I think right now is just untapped in our country. We talk about the resources in our country. These are human resources that are being untapped.

But let me ask you a question about the worst-case scenario, if we fall behind, if we lose the race on quantum computing, if we lost the race on AI, on 5G, on these other technologies to the extent that you can discuss it here, what is the worst-case scenario

for the United States?

Mr. Darby. I think the worst-case scenario for the United States, we don't have to look too far. If you look at Ecuador right now and you look at the export of the Chinese surveillance systems into Ecuador, based on sense time, which as many of us know, is probably the most valuable AI company in the world trained on Chinese imagery and algorithms, that is a surveillance platform that Ecuador ingested and if I read it is in the public domain, they are also using algorithms that they are getting from China.

This begins to be, in my mind, what the IC might characterize as an influence op. And when we think about the layered technology strategy that the great power competition is going to be based on, it is going to be based on things like 5G as a network, but then you get these surveillance technologies and surveillance can also be used in other applications.

So, for example, we are seeing right now with coronavirus that they are using that same platform to monitor for health. All right. Well, I have got a story for the populist that says this is good for you to do.

Based on 5G, again, if you look at the long-term trajectory of things like mobile payments. So if you look at Europe right now, they are all going to the WeChat mobile payment platform and Alipay, that means that the reconciliation of those financial transactions are going to go through Shanghai in the not too distant future.

And so my contention is that these fundamental infrastructures upon which countries are being built, if we don't have a place in that, we will not have a seat at the conversation around the norms and values that are being undertaken. It is troubling.

Mr. Patil. Thank you for highlighting the minority issue. Only 2.2 percent of Latinos are in STEM, 28 percent of women are in STEM despite representing 47 percent of the workforce.

On the side of what could go wrong, if you think about it from a Biomedical research, we have a strong and has been reported out, there are strong concerns about as China starts to work and collect large volumes of Biomedical data, in large part to process genomic research and as you get ahead with machine learning in AI, you will be able to have advances and a leading edge to the next set of drug discoveries.

As you get there, you have the ability to displace traditional companies that are in the environment right now and those would become the R&D base of those operations as well as the cash flow would be within China's ecosystem.

Mr. Castro. Anyone else?

Ms. Zuber. Yeah, one more. So if the Chinese develop quantum computing first, then traditional encryption methods will not work which is the fundamentals of the U.S. Banking --

Mr. Castro. -- your signal, WhatsApp, all that stuff.

Ms. Zuber. -- and everything else, so I serve on a bank board and we worry a lot about encryption and technology, so -- and I will also add this year's freshman class at MIT is 47 percent women.

Mr. Castro. Very good. And just one final comment in the few seconds that I have left. I think as Americans, none of us or hardly any of us at all have lived in an era where America didn't dominate the tech industry and set the pace for the world, and so we have as a Nation I think taken that position for granted.

So, you know, the worst-case scenario where you point out, it is basically the world using Chinese technology or somebody else's technology the way the world uses the United States financial system right now. And we, quite honestly, have never lived through what that means for us and for our allies.

And so I want to thank each of you in your own roles for what you are helping us

do to prepare to make sure that we stay ahead of the curve. Thank you.

I yield back.

Mr. Himes. Thank you. That ends our first round of questions.

I have a few follow-up questions and for any members who can remain, we will do another round and we will just go in order of seniority as we go here, but, again, thank you for your answers.

I want to go in a direction that we have not talked about yet today, which is what government can do and what we can all do to assure a healthy partnership between innovators out there and the government?

And I will make reference to some of the stories we have heard about the staff of Google objecting to participation in Project Maven. There was concern within Twitter that, I think, translated through to data miners business model. You may understand those concerns, but it is kind of inconsistent with the way the country has always behaved where the American corporate sector which, by the way, is a definitional term that probably made more sense 50 years ago than it did today when companies are by nature multi-national.

But I am very interested to hear from all of you in as much as you have thought about what we could be doing to make sure that that relationship is good and constructive. And just to further preface this question, as I sort of reflect on some of the attitudes or statements that were made in Silicon Valley and elsewhere.

It is not that you don't want the technology getting to a government, it may be which government should get that technology first. And so any way, I would like to open it up to the four of you to reflect on what we might do to form a more constructive and understanding partnership with the private sector.

Mr. Sinai. That is a great question, chairman. So I would first quickly state that

there is a lot of enthusiasm for government in the tech sector, and so the headlines tend to dominate.

You mentioned Project Maven, but you see a lot of folks in large tech companies and start-ups that are excited about the government mission set and want to serve or have served, and so this is -- it is easy to characterize those headlines, but it is actually a more nuanced story.

And so I think we can do a better job of collaborating with the private sector in a variety of ways. People flow being one of them, getting people in and out of government. Another one is finding ways to do business more productively and I do think that those are areas where the subcommittee could focus on.

Mr. Darby. I think -- I come back to the conversation that needs to take place. We don't speak the same languages. A lot of times when DOD goes to the valley, they are in uniform and if it is four stars, there are 50 people trailing behind. That is not the way the valley operates. The valley operates in a very casual mode and it is not about giving a written speech in front of an audience, it is about having a conversation in a cafeteria.

And I think we have got to do a lot more of that if we want to really engage the valley and, again, it is got to be an ongoing thing. When my colleague Steve Boucher, who runs the investments team and is based in our Menlo Park office, often says the reason I can have conversations around the government interest is because I drop my kids off at school with these people every day.

And when Stephanie Sullivan was the principal deputy DNI, she was asking me what I would do and I said, well, you know, I might build a big DNI building out there and have a much more significant presence so that you are dropping your kids off at school every day and you demystify this Intelligence Community or defense community.

These are just people and I agree totally with Nick, they do want to serve.

In-Q-Tel does not have a problem getting into early stage deals. They want to help this country.

Mr. Patil. I will just add too real quick. The first is the partisan nature of the dialogue that is happening at the national level is trickling in, and so if a technologist is asked how is the technology going to be used to support ICE or border security in different ways that are antithetical to somebody's belief that is where the polarization is hitting.

When somebody interacts in a company around encryption and questions where somebody says, you know, you just figure it out rather than trying to understand the math and why making back doors doesn't make sense. It makes it directly oppositional and aggressive rather than a problem-solving environment.

The second is most of the time when engagement happens with the government and industry is around a problem rather than the leg work that is taken before the problem actually happens and so we need to build that collaboration model where we are actually working more aggressively together on the on-ramp.

Ms. Zuber. Okay. I will answer your question from the standpoint of producing the future workforce for these companies.

When we signed our agreement for the AI accelerator with the U.S. Air Force, we didn't have a single person on campus complain about it and the reason was that we focused on problems that were of interest in protecting our colleagues in the military and it was something that resonated with our community and then it is very easy once you are in that place to take the next step of protecting those people who are protecting the people in our country.

So there is a narrative that one could develop, but it requires getting in and looking at the problems that you want to solve that happen to be very interesting to

young people, so basically, it is starting to teach them young and then it takes care of itself.

Mr. Himes. Thank you. Thank you very much. Mr. Carson?

Mr. Carson. Thank you, Chairman. Recently, Attorney General Barr floated the idea of the United States basically buying shares of technology companies like Nokia and Erickson to address the dominance of basically Huawei. Is this a great idea? And if so, would you -- what would you prioritize for U.S. investments?

Mr. Darby. So I think the United States should focus on doing what the United States does best and that is disrupt technically. I think Huawei is definitely beatable. If I look at 5G, we started investing in 5G 7 years ago at In-Q-Tel because we felt that it was going to be a national security interest.

If I fast-forward to today at Mobile World Congress, which is going on, there is only one company that is in the awards running for 5G and it is an In-Q-Tel portfolio company called Parallel Wireless. And so what they are doing is they are saying where can we disrupt Huawei and totally change the game, change the cost basis.

And it is in this place called the radio access network, which is where if we were to invest in any other firm whether it is Erickson or Nokia, we would be investing for that one piece of their business because companies like Cisco have the core and we have 5G handset manufacturers, what we are lacking is the radio access network.

So companies like Parallel Wireless and we have others in our portfolio are really trying to change the game. They are trying to change the cost basis and they are trying to do what the United States does best.

Now, does that solve the problem today? Probably not, but the 5G's going to be a long -- a long road to hoe. 5G today is like having a Ferrari in Georgetown. You can go really fast from one stop light to the next as long as there is not traffic. So I think we have

time to play the game the way we play it best, which is disrupt. It is easy for us to forgot that digital equipment used to exist.

Nortel used to exist. Compaq computer used to exist. The venerable Bell labs are now owned by Nokia. Titans can fall, and Huawei is a Titan right now and we could take them down if we want to double down on our investments.

Mr. Patil. I would add, we do best when we are innovating and fostering two kids and a dog in a garage or some new researchers who have an interesting idea and passion. When we invest in passion, unique things happen.

The other part is, with all due respect to Attorney General Barr, one of the things that is critical and this came to your point earlier, who are the SARS for data or these different aspects?

You need a U.S. chief technology officer, you need a U.S. chief data scientist, you need these people who have lived in multiple worlds to help ensure that we actually are approaching these from a perspective of offense rather than defense where defense is trying to control things from a shareholder value versus putting new bets down.

Mr. Carson. Thank you, Chairman.

I yield back.

Mr. Himes. Mr. Heck?

Mr. Heck. I am fascinated by the challenges that are presented by differences. Sometimes they are external. China has authoritarian command and control system so they are able to more quickly, efficiently mobilize for directed national security investments on the R&D side and application side presents challenge. Sometimes the challenges are internal.

You have this kind of market-base system in an uncertain public-private partnership is not always functional but causes us to have competitive challenges when it

comes to attracting and retaining talent.

One of the other differences that is both external and internal to me is our relative openness and especially that research which emanates from the university system, and I want to ask a question about that challenge to us.

First of all, I used to believe that our openness, our freedom significantly accelerated and reinforced creativity and innovation, and I want to know, kind of, yes or no if you think that gap within an authoritarian command and control country is being closed or do we still have a structural advantage that we believe in freedom and open thought?

And then I want to secondly ask about the internal nature of this challenge, especially between university system and the IC.

Now, I want to remind everybody that the job of the IC is to recruit spies and steal secrets and their culture is about keeping secrets and that is an inherent tension with an open system.

My perception is that more of the challenges on the IC side. That is a closed environment. That is their culture. That is their job is to keep secrets and so the question therein is, what is the most important thing we could do to move the people in the IC to amend their cultural perspective to enable them to do their job better of keeping us all more safe and secure.

So Dr. Zuber, I, again, want to pick on you.

Ms. Zuber. Sure.

Mr. Heck. Do we have a competitive advantage because we are an open and free society and is that gap closing with command and control countries who are now near competitors?

Ms. Zuber. Well, I mean, we saw a recent case where the coronavirus might have

been able to be sort of nipped at the bud had the fears and the concerns of a doctor been listened to in China as opposed to oppressed.

So in the U.S. I believe that we still do have an advantage. We still of the international students who come to the U.S. overwhelmingly their first choice is still to stay in the U.S. and be apart of our system because the freedom that they have to go in directions that are interesting to them lead to discoveries and their discoveries won't be oppressed.

So I believe that we still have that advantage and we are still the location of choice for the brightest minds who can benefit the most from that advantage.

Mr. Heck. Mr. Darby, I guess I am going to ask you, what do we need to do with the people in the IC to get them to understand that openness, freedom contributes to innovation and creativity which serves us all and how it is that they should amend their cultural perspective in some ways?

Mr. Darby. I think the IC is making tremendous strides in those areas. I think if we look at the open source center initiatives, I think if we look at their move to the cloud, commercial cloud technology.

I think that the IC if you look at it, they have incredible talent and incredible acumen in the Intelligence Community in the United States and I think that we can't lose sight of that. They are walking a very, very delicate balance between the secrets that they rightly need to keep and the necessity to avail themselves of all of the open data that is out there.

I will say that in my 14 years again at this job, they have made tremendous strides, just really, really positive strides. I think that to the extent that we can still adjust things like the HR system, incent them to take more risk right now.

You never got fired for buying IBM was the old saying. Well, I think that if we can

change the culture to have it reflect a little bit more of Silicon Valley where you can take risk and you aren't penalized for taking risk if it doesn't quite work out the way you want it to.

Now obviously you can't do that in all areas of the IC. There are fundamental areas where we can't afford to take those risks, but where we can, we should, and we should create a culture that allows them to lean in.

Mr. Heck. Thank you.

Mr. Sinai. I wanted to quickly add if I may.

Mr. Heck. Up to the chair.

Mr. Himes. Yep. Proceed.

Mr. Sinai. Thank you, chairman. The Department of Defense and the Air Force have been doing some interesting things here that I would encourage this subcommittee to look at. So they have been doing training of mid-career acquisition professionals, of senior generals and SES.

And so they have done things where they have brought them together with the start-up community and the VC ecosystem and so it is entertaining to see a bunch of generals in jeans working with start-ups and learning, but these training programs, the Air Force one is called Project Banshee, which I participated up in -- it is run out of Hamscomb, and they expose acquisition professionals to the start-up and scale-up ecosystem and it is tremendously important because there were acquisition officials who were asking me, well, wait a second.

Why can't my contractor just build this thing that you are talking about? And I explained how start-up entrepreneurs, you know, their competitive advantage of talent and technology and all of these things and why they couldn't simply take those requirements and then put that in their program of record? And you could see those light

bulbs going off and if the Air Force is doing this for a few acquisition officers up in Massachusetts, it is worth thinking about how we take these training programs into the IC.

Mr. Heck. Thank you.

Mr. Himes. Mr. Castro?

Mr. Castro. I raised the issue earlier about the fact that the United States has dominated the high tech industry for a few generations, at least.

Part of the way that you can tell that is that you have foreign students who come to the United States to universities like MIT and Stanford and Caltech and others to study. Many of them as you noted stay here. Some go back home or somewhere else.

But I want to ask the question, how many Americans are going overseas now, going to China or some where else? In other words, have the ratios started to move where you have more Americans that are actually going somewhere else? And I would suggest that if it hasn't happened now, that would start to be one indication that some other place is becoming the place to be.

Mr. Darby. So I would look at it -- I would look at it just a little bit differently, which is, are we seeing different dynamics within, for example, the start-up ecosystem? Right now all development in start-ups is distributed and it is increasingly distributed internationally.

Part of that is the cost basis here. DJ and I were talking about it a little bit earlier. The cost basis in Silicon Valley is very, very high. The cost basis outside of the United States is not as high.

In-Q-Tel has offices in London, England and Sydney, Australia as well, and I will tell you the cost to start a company in Australia comparatively is pennies on the dollar versus the United States.

Mr. Castro. Are you suggesting that Americans are going and starting companies in London or Australia?

Mr. Darby. I think that certainly the American venture capitalists are increasingly looking at the companies over there. I think that your, at the very least, your development efforts are being done over there and those are a critical part of your companies, so we are losing some of the development talent to your point that we need to foreign locations.

Mr. Patil. I would add, one of the interesting examples that we are seeing in AI is the amount of investment that is happening in Toronto. Many Silicon Valley VCs now go regularly to Toronto to look at companies there. Students who are in AI because of technology technique called deep learning is becoming a central place.

There is obviously many great places in the United States, including see sale at MIT, but one of the things that we are also seeing is that students that are transitioning, they don't necessarily have to be immigrants, are looking at the cost of student debt and student loan cost and staying in those countries where they have a form of forgiveness versus taking that debt and being burdened here in this country.

So I think we have to look at -- and one of my recommendations is, right now we do have student loan forgiveness at 10 years for national security areas that are considered Moon shot. We should think about moving that to 5 years.

Ms. Zuber. So we have seen some loss of U.S. researchers at universities to foreign countries as the amount of Federal funding for research has declined.

Mr. Castro. Sure.

Ms. Zuber. So initially it has been more to Europe to places like Etaha in Switzerland that there is a large internal investment, so professors come with a very, very large sustained amount of funding.

Mr. Castro. Do you see people saying -- well, Americans saying instead of choosing MIT, I am going to go to Europe somewhere?

Ms. Zuber. Well, they usually let us pick them as system professors and then they recruit them away from us, usually. But we are starting to see, you know, China, so I had -- I had a -- a Chinese post doc who was given a system professorship at Shingwah University and he was given the resources that were equivalent to a full professor at a U.S. university to just start out.

Mr. Castro. Sure. And I guess I would just note that losing people to Europe is different than losing people to China, too, right? My last question, because I only have about 45 seconds, how extensive is China's data theft around the world? We talked about their own systems and the fact that within their own population they are acquiring data. What about data theft around the world?

Mr. Patil. So the way I can answer it here is, I would think about it as less about data theft, but more about how do they create interesting data sets.

And so if you are in China and you are trying to create a very rich genetically diverse data set of DNA, you may not have that in directly in the Chinese population, but if you are getting contracts with and doing sequencing for the population in Africa, you are able to have that DNA --

Mr. Castro. So it is not really theft, I guess, right? You are partnering with African countries or governments --

Mr. Patil. That is right. That is right. And it is this dimensionality of how do you create richness in the data.

Mr. Castro. Sure.

Mr. Patil. And we have a disproportionate advantage on that right now, but through those contractual measures they are able to do that. The fallback of least resort

is then stealing data.

Mr. Castro. Sure. Thank you.

Mr. Himes. Thank you, Mr. Castro.

I have just a couple of cleanup questions I would like to ask and I will afford my colleagues the opportunity to do the same before we adjourn the hearing.

Let me start with a question to all four of you and ask that the answers be brief. We have done exactly what I have hoped we would do today which is sort of reflect on systems and processes rather than particular verticals of investment, but they are obviously a lot out there and Mr. Darby you pointed, in particular, to microelectronics so I would love to just quickly -- and we will follow-up on this -- inasmuch as you think there are burning areas of under investment, AI, quantum, whatever it may be, I would love to get that on the record. And again, we won't elaborate because we will have an opportunity to follow-up, but let me start with Mr. Sinai.

Mr. Sinai. So I will refer back to my earlier comments that software is eating world and software is eating government. It is probably eating the IC as well and so how we build, buy, and evolve software in the IC is critical and that includes AI, cyber, digital, all these important topics inside of the IC.

Mr. Himes. Do you have reason to believe when you identify AI and software in general that we are at a competitive disadvantage or behind in our innovation and development there?

Mr. Sinai. No. I think we have some of the greatest companies in the world in that space. There is certainly risks and we have talked a little bit about that, but the part where I worry about is getting those into government because we have a siloed government.

It is challenging for those technologies to interact and collide with the mission and

that is what worries me.

Mr. Himes. Thank you. Mr. Darby?

Mr. Darby. I think all roads lead to two places, microelectronics and biotech. If you look at the underpinning for technology around the world, it is largely been microelectronics. DJ's dad had a big part to do with that, and if we cede that to anybody, we run the risk of losing everything that is layered on top of it.

And so I really want us to be disrupting in the microelectronics space going forward and I truly believe China's long-term strategy is actually a bio strategy, and I had heard that a Chinese scientist said -- scientist from China, more explicitly said, the Europeans won the industrial revolution, the Americans won the IT revolution, and in China we are going to win the bio revolution.

And if you look at what they are doing with Beijing Genomics Institute and amassing these huge genomes -- they are sequencing everything -- and if you combine that with AI in the whisper tool, they can solve for health, they can solve for food, they can solve for climate, and they will have an advantage over everyone else if they can do those things, so those are the two areas.

Mr. Himes. Thank you. DJ?

Mr. Patil. I would echo what Chris said about bio is my fear for our kids is that within the next 20 to 50 years the traditional model for how we think about western companies really delivering on the value proposition for medicine is replaced with Chinese companies, especially around genomic medicine and the ability to truly create tailored medical treatments for individuals and rare diseases as well as chronic disease.

Specifically, one of the areas that I am concerned about as we think about what happened in semi-conductors and my father was one of the key people in this as Chris mentioned, is we saw the idea of the actual fabrication environments move offshore and

how do you actually think about what became known as fabulous semi-conductors.

Right now as we think about where does sequencing and the manufacturing of actually taking bio material, getting the genetic sample, getting the analysis done, where are those machines? Who does that pipeline? Where is that controlled? It is starting to become easier to do that offshore. I think we need to invest to create corridors.

We have that end to end production facilities, analysis facilities, all of it here in the United States.

The second one I would just add real quick is open source technologies. Time and time again, I found in my time in Federal service, I was the router for people in the IC and vice versa to say, there is an open source technology that so-and-so is building or working under.

This company, this company, and this company are collaborating together. We need more of that kind of collaboration so that we don't have two worlds that are building software that is independent versus the joint collaboration that will benefit each other.

Countries like Israel, China, other places, India, are doing that already and benefiting that cross-pollination from the actual technology software layer of open source technology.

Mr. Himes. Thank you.

Ms. Zuber. So I agree with what everybody said about the technology, so on the microelectronics AI, quantum additive manufacturing, 5G, those are all critical areas for us. We are on the case with that and we could develop a plan. I would say we don't have a plan right now, but we could get to a plan because the DOD and the Intelligence Community are thinking about it.

We don't have the kind of depth of knowledge on the biotech side within those

communities that we have in the other engineering areas and so that is my greatest concern as well, because the biotech industry in this country is trillions and were we to cede that to China, our entire healthcare system is based on that.

Mr. Himes. Thank you. I appreciate that. Before I recognize Mr. Heck, it is interesting that three out of four of you raised biotechnology. The focus of the subcommittee obviously is the Intelligence Community where there probably is the smallest of overlaps in terms of applications, but obviously this has implications well beyond the jurisdiction of this subcommittee, so we will be working with our friends in science and technology also to make sure they understand your urgency. With that, Mr. Heck, anything? That is it?

Okay. I have one last question. In some ways it is a summarizing question. DJ, playing off your statement that we do best when we are helping two kids and a dog in a garage. That is certainly the sort of iconic image of Silicon Valley.

It is also a little at odds with the development of atomic weaponry in the Manhattan project and it is certainly at odds with what we see happening in China today where, in addition, to the bio technology effort you made reference to, my understanding is that there is a city being built around the concept of advancing artificial intelligence.

So give us a mental construct to think about that. I assume it is not either/or, but how, in particular, for lay people like ourselves, how should we think about those different models, which we should favor, how do we think about it?

Mr. Patil. Thank you for asking that. It is very easy to make it binary in the either/or when it needs to be an and. We have to increase, as you pointed out your opening statements, the base level of R&D funding and we need to figure out how to actually align that around key Moon shot areas.

That will help align the funding. We simultaneously also have to figure out how

do we fund new ideas in research and academia where they are new, exciting ideas, but they don't fit the traditional models for the national institutes for health or the National Science Foundation. They are intersection areas.

We have had a challenge in this country funding things that don't fit the traditional paradigm of the way a university is structured or the Federal Government is structured. Bio engineering is a terrific example or computational bio because it sits one part in the National Institutes of Health, one part in the Department of Energy, one part in National Science Foundation, and getting those agencies to work together is a challenge.

The subsequent portion of this is, we do have to find how do we enable people to try new things where they just want to innovate and they want to play and they are able to fail very quickly and get back up and try a new idea.

And that environment is very optimized for the start-up world because you are actually trying to take an idea that has some premise that has been foundational from the ideas of investment from the Federal Government to academia and taken forward.

Google is a great example of this. The distributed computing, page rank algorithm, the spark that ignited that was Federal funding. Then you had Larry Sergei working in a garage with a team to actually make that into a product that we see has value of search, and so that hopefully elucidates a little bit of that why we can't have one or the other; we have to have all those pieces firing on all cylinders.

Mr. Himes. Any further thoughts from the witnesses?

Mr. Darby. In my testimony I talked about a national technology strategy, an all-of-government approach to this and I tend to look at it from a systems engineers perspective.

Where is the white space? The white space is where the start-ups in the garages

will really fit. There is a role for the systems integrators, there is a role for the big companies, there is a role for the emerging technology companies.

Start-ups are not a panacea to solve all of these problems and so I would encourage us to start with the piece of paper and say, this is where this country's going to differentiate itself over a long period of time given where we think the competitive, the geostrategic competitive landscape is going.

Once we have done that, then I think we can begin to say, well, we are going to count on the start-ups over here, our trusted industrial base here. This is not hard if we look at it from a systems perspective.

Mr. Himes. Mr. Sinai and then Dr. Zuber.

Mr. Sinai. Just very quickly. I am a huge fan of start-ups and I think they play a critical role and I am a huge fan of R&D. Sometimes we forget about scale-ups. Those companies that are becoming, you know, between when Google was in the garage and Google today.

There is that period of innovation that led to a lot of important collaboration with the Federal Government, and I see that from my vantage point is that there is a lot of companies that are growing fast, they are investing tremendously in their product innovation and we want to make sure to Chris's point that we include scale-ups in this whole piece of how do we do a national innovation strategy.

Ms. Zuber. So I will just end by saying, let's remember that to do all these things that you are talking about, we need the workforce of the future, okay?

So we have got to do more to encourage individuals to go into STEM and this is at all levels. And I want to highlight the whole STEM aware where you don't need a degree in a STEM field, you might need a course or you might need some training on how to run certain kinds of machines.

So at all levels we need to improve our education in those areas and make that education available to the people who are going to fuel what we -- what I hope is going to be a revolution.

Mr. Himes. Well, thank you all. I would like to thank all of our witnesses for their testimony today.

As we close, I want to emphasize how important I think this is and there is a little bit of a paradox because getting this innovation and leading on it, getting it wrong or right, is the stuff of Hollywood movies.

Artificial intelligence and the promise that we might some day have a computer that can think and act like a human. Artificial intelligence and the possibility it may create a sort of pan octagon in which there is zero privacy in a surveillance world, biosynthesis where you hear about the possibility of deliberately targeted viruses, maybe even targeted against specific ethnic groups are horrifying possibilities.

By the same token, of course, it is the Hollywood stuff that we don't dream of that might happen. I often in the ongoing and very good conversation that we have in this country about the role of government, I will wave this around.

For the record, I am holding up a smartphone and I say that everything that is cool about this device, this semi-conductor, the voice recognition, the location services, the GPS satellites originated, at least in the basic research, in a government lab, and so the economic possibilities are absolutely remarkable.

And I just think this thing is amazing. I wish more of them were manufactured here in the United States, but this is United States intellectual property created largely by government research that the private sector used to build, but not just amazing consumer choice, but a remarkable economy.

But the things we need to do to win are not the stuff of Hollywood. We have

talked about HR and semi-conductors, even the fashion choices of flag officers in the hearing today and I think it is up to us to do the hard work of making sure that we get that right, the stuff that isn't of Hollywood movies so that this is not the first generation to give up the opportunities that previous generations gave to us and certainly not the first generation to drop the ball in a way that would damage the ability of our Intelligence Community to operate and the national security of the United States.

So with that I will thank you all, again, and we are -- without objection, members are granted up to 3 legislative days to submit written questions to be answered by any of our hearing witnesses in writing. Those questions and your answers will be made part of the formal record.

With that, the committee stands adjourned.

[Whereupon, at 11:52 a.m., the subcommittee was adjourned.]