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CLIMATE CHANGE IN THE ERA OF STRATEGIC COMPETITION

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HOUSE OF REPRESENTATIVES,
COMMITTEE ON ARMED SERVICES,
SUBCOMMITTEE ON INTELLIGENCE AND
EMERGING THREATS AND CAPABILITIES,
Washington, DC, Wednesday, December 11, 2019.

The subcommittee met, pursuant to call, at 2:37 p.m., in room 2118, Rayburn House Office Building, Hon. James R. Langevin (chairman of the subcommittee) presiding.

OPENING STATEMENT OF HON. JAMES R. LANGEVIN, A REPRESENTATIVE FROM RHODE ISLAND, CHAIRMAN, SUBCOMMITTEE ON INTELLIGENCE AND EMERGING THREATS AND CAPABILITIES

Mr. LANGEVIN. The subcommittee will come to order.

We want to welcome everyone to today's hearing on "Climate Change in the Era of Strategic Competition."

Today we will receive testimony on the impacts of climate change, from extreme weather events to changing Arctic ice coverage, on U.S. national security and how the Department's strategies and plans are addressing those critical challenges.

Climate change appears to present three types of threats: direct threats to U.S. military installations, and to our ability to train and execute various missions, and more indirect geopolitical unrest. The IETC [Intelligence and Emerging Threats and Capabilities] Subcommittee held a joint hearing with the Readiness Subcommittee exactly 8 weeks ago today to discuss the resiliency of military installations to emerging threats, including climate change.

Today's follow-on hearing is meant to highlight the threat that climate change presents geopolitically; home in on the Department's efforts to plan for the emerging operating environment; and hear about innovative approaches and technologies to address and ameliorate the threat.

The Armed Services Committee, and this subcommittee in particular, has placed considerable focus on the intersection of climate change and geopolitics, and how that intersection implicates our strategic and operational planning. There's broad bipartisan agreement that climate change is going to have a significant—is going to have, and is having, significant implications for our defense posture. I want to be clear, the purpose of this hearing is not to debate the relative criticality of climate change as compared to other emerging threats, but rather to understand how climate is impact-

ing our security, our ability to operate and to plan, and how climate change shapes the threats that we are already watching.

How has Russia changed its posture in the high north to take advantage of an increasingly Arctic-free—ice-free Arctic, and how does drought in Iran inform the decision making of its leaders, as it would affect the decision making of leaders in other parts of world? Are violent extremist organizations, like Boko Haram, taking advantage of water scarcity and how is it affecting our food supply around the world to increase their power and influence? And what parts of world do we expect climate stresses to drive instability?

So while I would have preferred to have our—have your senior leadership testify—and I want to put this on the record—we wanted to have your senior leadership testify before the subcommittee, I do want to thank all of our witnesses here today for your willingness to speak on this critical topic.

So with that, I will now turn to Ranking Member Stefanik for her remarks. Before I do that, I want to thank the ranking member for your bipartisan support and recognition of the challenges that we face with respect to climate; and I want to turn the floor over to Ranking Member Stefanik.

[The prepared statement of Mr. Langevin can be found in the Appendix on page 27.]

STATEMENT OF HON. ELISE M. STEFANIK, A REPRESENTATIVE FROM NEW YORK, RANKING MEMBER, SUBCOMMITTEE ON INTELLIGENCE AND EMERGING THREATS AND CAPABILITIES

Ms. STEFANIK. Thank you, Chairman Langevin, and it has been a true privilege to work with Jim on these issues for a number of years. Thank you for holding this important hearing today to discuss the critical role that the environment plays in our national security. I also appreciate that we will be discussing this within the context of strategic competition and the Department's planning efforts to support the National Defense Strategy, or NDS. Welcome to our witnesses. It is great to see you today.

As you know, the issue of strategic competition as identified within the NDS can best be summarized as a challenge to U.S. prosperity and security from other nations, namely China and Russia, who seek to shape our economic, diplomatic, and security decision-making processes to their own advantage.

When this committee hears from the Department of Defense about the National Defense Strategy, we often focus on policy issues and emerging military capabilities. It is important that we also consider the economic, diplomatic, and environmental impact on our constituents. A strong economy and clean environment are the most visible and public sign of American strength. The United States cannot unilaterally address the human causes of a changing climate.

China is the world's largest emitter of greenhouse gases, and is currently building more coal-powered electrical production plants than the rest of the world combined. In fact, they are adding more coal fuel generation capacity than the entire European Union currently operates. Yet their existing capacity isn't even close to being

used at full capacity, sitting idle for long periods of time. Because of poor energy sector management, China will negate the rest of the world's efforts to reduce greenhouse gases.

In addition, nearly 50 percent of Russian Government revenue comes from taxes on fossil fuel industries, and the Kremlin recently announced tax breaks for oil exploration. Russia also plans to boost coal production in an effort to capture as much of the current market demand as possible, while also betting on the slow transition to cleaner energy sources.

This committee and the American public are very aware of Russian efforts to control the information environment through internet trolls and state-backed media outlets. What is less known is that these same pro-Kremlin propaganda platforms routinely spread disinformation about climate-related issues, mostly focused on European nations, to undermine efforts to reduce reliance on Russian energy sources. Just like we must consider our competitors' military capabilities when we are modernizing our own defenses, we must consider the actions of other nations when developing solutions to a changing climate.

Globally, a changing climate will provide additional instability in already fragile regions like the Middle East, Africa. It will create challenges for emerging nations in Southeast Asia, and could fuel rising tensions in contested areas like the Arctic.

At the local level, we have seen—we have also seen the negative impacts of a changing climate in our communities, including in my own district in upstate New York. Pollution, extreme weather events, and invasive species threaten our native plants and wildlife; and they are harming productivity in key economic sectors such as construction, agriculture, and tourism, putting pressure on State and Federal budgets and adding to our long-term fiscal challenges.

While most of the efforts to address climate change lie outside of this committee's jurisdiction, I am proud to work in a bipartisan manner with all of my colleagues to develop consensus-driven legislative solutions. I believe that our approach to addressing this issue must be done in a way that does not restrain, but enhances our ability to compete globally.

And I want to mention one commonsense effort the Department is making at Fort Drum in my district. Fort Drum is 100 percent energy independent, using renewable sources to power training capabilities and enable operational flexibility, ensuring that we are resilient, energy secure, and ready for the 21st century challenges.

I look forward to hearing additional feedback from our witnesses today.

And with that, I yield back.

Mr. LANGEVIN. I thank you, Ranking Member Stefanik, and I thank you for your remarks.

And I will turn to the—our witnesses. In January 2016, the Department assigned responsibilities for addressing the major risks to readiness and the vulnerabilities posed by climate change. Today, we will hear from individuals from the organizations tasked with executing those responsibilities.

First, Dr. Neill Tipton is the Director of Defense Intelligence in the Office of the Under Secretary of Defense for Intelligence, USDI.

The USDI is tasked with overseeing the planning, organizing, coordinating, and balancing of climate change for all DOD [Department of Defense] intelligence. The organization also coordinates with the DNI [Office of the Director of National Intelligence] on all related risks, potential impacts, considerations, and effects of altered operating environments related to climate change and environmental monitoring.

Next, Ms. Maria Langan-Riekhof is the director of the Strategic Futures Group at the National Intelligence Council within the Office of the DNI. Ms. Langan-Riekhof's organization is responsible for the Global Trends strategic assessment that outlines how key trends and uncertainties, including climate change, should inform the national intelligence community and senior leaders.

Mr. Victor—Mr. Victorino Mercado is the Acting Assistant Secretary of Defense for Strategy, Plans, and Capabilities in the Office of the Under Secretary of Defense for Policy [USDP]. The USDP is tasked with developing policies, plans, programs, forces, and posture needed to implement the DOD strategy, including adapting actions to increase resilience to climate change.

And, finally, Dr. Milan Nikolich is the Director of Defense Research and Engineering for Research and Technology in the Office of the Under Secretary for Research and Engineering [R&E]. The Office of R&E is tasked with overseeing defense-related research in climate science for the development of approaches and technologies that reduce risk and promote mission execution.

With that, we will start with Ms. Riekhof, Ms. Langan-Riekhof, to begin the opening statements.

STATEMENT OF MARIA LANGAN–RIEKHOF, DIRECTOR OF THE STRATEGIC FUTURES GROUP AT THE NATIONAL INTELLIGENCE COUNCIL, OFFICE OF THE DIRECTOR OF NATIONAL INTELLIGENCE

Ms. LANGAN-RIEKHOF. Chairman Langevin, Ranking Member Stefanik, and Chairman Garamendi——

Mr. LANGEVIN. Can you pull your mic down?

Ms. LANGAN-RIEKHOF. It looks like it is on. Better? Okay. Thank you. And distinguished members of the committee, thank you for the opportunity to discuss the intelligence community's assessment of the national security implications of climate change.

In my opening remarks, I will speak briefly about how the intelligence community approaches this topic; and I will highlight a few of the key implications for national security.

The role of the intelligence community is to provide timely, objective, and relevant insights to advance national security. Our job is to consider all factors that could affect the global threat landscape, and this includes climate change. We examine how climate trends affect U.S. national security across a range of issues and dimensions. To inform our judgments, we rely on reports produced by U.S. Federal science agencies, peer-reviewed scientific journals, and reports from scientific organizations and panels.

The intelligence community uses this reporting stream in conjunction with our all-source intelligence reporting. Our analysts produce intelligence assessments focusing on the implications for

national security, and their work will be reflected in my testimony today.

As we discuss these assessments, I would like to underscore a couple of points about what we do and do not know. For one, it is difficult to discern the national security implications of climate change in isolation, because it interacts with other environmental conditions and human factors. In many cases, climate change exacerbates existing stressors, such as natural resource constraints that contribute to food and water shortages.

Second, it is difficult to project when and where specific disruptive events and other climatological effects will have the most significant national security impact because of the complexities in the Earth's systems, uncertainties in modeling, and the unpredictability of human choices. We do make judgments about the general risk factors.

And in the next several years, we assess that the security risk for the United States linked to climate change will arise primarily from distinct extreme weather events, and from worsening preexisting problems around the world. The very studies I mention generally agree that during the next 20 years and beyond, climate change will increasingly compound extreme weather events. Many scientists warn that the abrupt—the risk of abrupt climate change, which would have the most severe and national security implications, will increase over the next several decades and beyond.

I would also like to remind everyone that the intelligence community does not assess the direct impacts of climate change on the U.S. homeland.

So, turning to some of the key implications of national security, I have submitted a statement for the record that provides our assessment of some of the effects of climate trends on various facets of national security. In my time this afternoon, I would like to highlight three of these: potential political instability, Arctic competition, and China's approach to climate issues.

In the coming two decades, we assess that an increasing number of countries will encounter climate-related hazards such as extreme weather events, drought, heat that will stress their capacity to respond, to cope, and to adapt. We already have seen water crises exacerbate social unrest and immigration from fragile states in the Middle East and North Africa, such as Syria and Libya, in part by aggravating the effects of other factors including preexisting socioeconomic grievances, ineffective government institutions. With continued rising temperatures, more countries are likely to face such challenges with greater frequency, increasing the risk of unrest, of migration, and inter-state tension.

Countries with weak political institutions, poor economic conditions, and other existing risk factors, such as political strife, probably will be the most vulnerable to climate-linked instability or migration and would be the hardest-pressed to respond and to recover from these crises.

Second, we assess that the changing conditions in the Arctic will have significant security, economic, and social implications for both Arctic and non-Arctic states. Scientists tells us that the Arctic is warming at rates more than twice as fast as the rest of the earth. The Arctic would be free of ice cover in the summer, potentially as

early as 2030, making it more consequential for economic insecurity reasons.

These conditions would drastically shorten maritime routes between Asia, Europe, and North America and enable increased commercial activity including mining, energy exploitation, shipping, and fishing. As a result, the Arctic is emerging as a new domain for strategic competition as Russia, China, and others are dramatically increasing their activities and investments in the region.

And, third, China is attempting to boost its image as a leader in combating climate change, despite its role as the largest carbon emitter, and its continued support for high emissions development globally. China played a pivotal role in 2015 in broadening the scope of commitments by developing countries under the U.N. Framework Convention on Climate Change, and China repeatedly touts its more than $100 billion in annual investments in green technologies.

However, the country remains the world's largest coal consumer, and is building mostly low-efficiency, coal-fired power plants abroad. Beijing is likely to continue to avoid energy decisions that impose significant economic costs.

Climate change and its resulting effects have wide-ranging implications for national security, presenting both risks and challenges for the U.S. The IC [intelligence community] plays an important role in identifying and analyzing these implications for policymakers. We appreciate the opportunity to discuss our analysis and to share our work with Congress and the American people. I look forward to your questions.

[The prepared statement of Ms. Langan-Riekhof can be found in the Appendix on page 29.]

Mr. LANGEVIN. Thank you very much.

Mr. Mercado, you are recognized for 5 minutes.

STATEMENT OF VICTORINO MERCADO, PERFORMING THE DUTIES OF ACTING ASSISTANT SECRETARY OF DEFENSE FOR STRATEGY, PLANS, AND CAPABILITIES, U.S. DEPARTMENT OF DEFENSE

Mr. MERCADO. Chairman Langevin, Ranking Member Stefanik, Chairman Garamendi, and distinguished members of this committee, thank you for the opportunity to be part of this hearing on climate change and strategic competition.

It is a privilege to be here together with my colleagues and to speak on behalf of the Office of the Under Secretary of Defense for Policy. I will focus my remarks in the Department's approach to protecting U.S. national security interests in the Arctic, a region in which changes to the physical environment are especially apparent and strategically important.

The Department assesses long-term threats, risks, and challenges including in the Arctic within the context of the National Defense Strategy. The NDS was released in 2018 and is the Department's guiding document on the key security challenges facing our Nation. The NDS is clear that the primary challenge to the United States security and prosperity is the reemergence of long-term strategic competition with great powers. The strategy states

that the erosion of our military advantage against China and Russia is undermining our ability to deter aggression in key regions.

Moreover, as the strategy makes clear, the threats posed by China and Russia are immediate, pressing, and of an order of magnitude that sets them apart from other challenges. We are seeing the strategic competition take place in key areas across the globe, including in the Arctic. While the Department has oriented towards addressing strategic competition, we continue to recognize the existence of a range of other challenges. The effects of a changing climate—climate change, are one such issue.

The Arctic is a region in which strategic trends are amplified by the effects of the changing climate and physical environment. Most notably, the Arctic continues to grow more accessible as the sea ice diminishes. The Arctic is becoming more navigable over greater periods of time, resulting in increased interest in activity in the region.

Countries are exploring the potential of Arctic shipping routes, as well as opportunities in natural resource development and tourism. The door is opened to increased activity in the Arctic by the United States, our allies, partners, but also our strategic competitors. The Arctic will continue to be characterized by extreme temperatures, vast distances, magnetic anomalies, which complicate communications and market seasonal variations. Together, these conditions form a harsh and demanding operating environment for all, including the U.S. joint force.

The DOD 2019 Arctic Strategy takes into account these environmental conditions as part of the Department's strategic approach to the region. We developed this strategy at Congress' prudent direction, updated from our 2016 strategy, because of the strategic significance with which the Department views the Arctic.

Our Arctic Strategy is anchored in the priorities of the NDS, and frames the Arctic in a broader geopolitical context. It recognizes that competition in the Arctic is one dimension of a wider global competition. Addressing competition in the Arctic requires the Department to effectively implement the NDS, as well as take specific steps for the region using a whole-of-government approach.

The Department's desired end state for the Arctic is a secure and stable region where U.S. national interests are safeguarded, the U.S. homeland is defended, and nations work cooperatively to address challenges. This end state recognizes some of the distinctive and historic characteristics of the Arctic security environment. The Arctic has been largely stable and a conflict-free region partly because of its relative inaccessibility and the geographic barriers to human activity in the region. It also reflects the deliberate decisions of Arctic nations to engage constructively on shared challenges in the region.

The immediate prospect of conflict in the Arctic continues to be low, but the Department maintains a clear-eyed approach to our competitors' activities and their implications for U.S. interests. In making these assessments, we begin with the fundamental difference between Russia and China.

Russia is an Arctic nation. China is not. Russia's military investments in the Arctic contribute to its territorial defense, but may have implications for access to the region. China is seeking a role

in the Arctic to include governance, despite it having no territorial claims in the region. There is a risk that, to further its ambitions, China may repeat predatory economic behavior in the Arctic that it has exhibited in other regions.

The DOD Arctic Strategy establishes three defense objectives derived from the NDS that guide the Department's approach to addressing competition in the Arctic: Defend the homeland is number one; compete, when necessary, to maintain favorable regional balances of power; and ensure common domains remain free and open.

Our network of allies and partners are key strategic advantage for the U.S. in the Arctic. They are the cornerstone of the Department's strategic approach. Six of seven other Arctic nations are either NATO [North Atlantic Treaty Organization] allies or NATO Enhanced Opportunity Partners. Our allies and partners are highly capable and proficient in the Arctic region's arctic conditions. They also share the U.S. interests in maintaining the international rule-based order including in the Arctic region.

Thank you for the opportunity to testify, and I look forward to your questions.

[The joint prepared statement of Mr. Mercado, Dr. Nikolich, and Mr. Tipton can be found in the Appendix on page 36.]

Mr. LANGEVIN. Thank you, Mr. Mercado.

Next, let me properly say the title. It is Director of Intelligence, Director of Defense Intelligence, Collection, and Special Programs. We will now hear from Dr. Neill Tipton.

STATEMENT OF NEILL TIPTON, DIRECTOR FOR DEFENSE INTELLIGENCE (COLLECTION AND SPECIAL PROGRAMS), OFFICE OF THE UNDER SECRETARY OF DEFENSE FOR INTELLIGENCE

Mr. TIPTON. Chairman Langevin, Ranking Member Stefanik, and distinguished members of the subcommittee, thank you for the opportunity to testify today on the role of the defense intel enterprise's understanding the implications of climate change during this era of strategic competition.

As the representative for the Under Secretary of Defense for Intelligence, I concur with the statements you heard from Maria Langan-Riekhof from the Office of the Director of National Intelligence, and the NIC [National Intelligence Council] and their overarching assessments on the implications of climate change and extreme weather; and we will continue to rely on these entities for their strategic perspective on these changes to our world.

While the DIE [Defense Intelligence Enterprise] executes many roles in the Department, none is more vital than our direct intelligence support to warfighters. In order to stay ahead of potential threats, we are working a number of relevant initiatives within the Defense Intel Enterprise. We are ensuring the U.S. and allied safety of navigation. We are monitoring geopolitical boundaries for climate change-related disputes, and we are expanding our portfolio of partnerships.

The Department of Defense, primarily through the National Geospatial-Intelligence Agency, maintains worldwide maritime and aeronautical safety of navigation databases, products, and services in support of U.S. and partner warfighters. Impacts to the shore-

lines of the world require continuous data collection and updating of safety of navigation products. We rely on this data to ensure the U.S. maintains its ability to project power worldwide.

The warming in the Arctic is leading to an increase in access to previously inaccessible areas, and a corresponding increase in military and commercial activity above the Arctic Circle. The warming in this region increases or will increase human activity, and lead to a potential for increased disputes to access and resources. To provide policymakers and warfighters with a better common operating picture in these areas, the Defense Intel Enterprise and our IC partners are conducting a review of four maritime claims in the Arctic region, where some states assert overlapping entitlements, and this assists both defense and national policymakers in providing clarity in resolving potential disputes.

In addition, we recognize that global resource competition will remain an ongoing national security risk. As assessed by the Defense Intelligence Agency, several regional conflicts in recent years have been exacerbated by disrupted access to critical resources. Shortages in food and water are often driven by a combination of poor resource management and extreme weather events, such as extended droughts.

Whatever the root cause, prolonged resource shortages are likely to contribute to population displacement, and further worsen geopolitical instability and humanitarian crises in already fragile and poor economies. Monitoring these trends will become more important so we can help prioritize and mobilize our humanitarian and disaster relief efforts.

The Defense Intel Enterprise recognizes that we are only one stakeholder in this area. In addition to the traditional military intelligence sources and analysis that we use, and the substantive support we get from the intelligence community, we rely on a substantial amount of scientific reports to provide accurate assessments for decision makers. As such, Defense Intel Enterprise components are involved in a number of partnerships with academia and other Federal science agencies through a variety of channels such as various working groups and grant processes. This enables us to work in an innovative environment with America's talented scientists on extremely complex models, some of which provide the Department with the ability to view changes in topographic features and geography over time.

So we will—the Department will focus on ensuring it remains ready and able to adapt to a wide variety of threats, regardless of the source, to fulfill our mission to ensure our Nation's security.

Thank you, again, for the opportunity to appear before you today, and I look forward to your questions.

Mr. LANGEVIN. Thank you, Mr. Tipton.

Dr. Nikolich, you are recognized for 5 minutes to summarize your statement.

STATEMENT OF MILAN NIKOLICH, DIRECTOR, DEFENSE RESEARCH AND ENGINEERING FOR RESEARCH AND TECHNOLOGY, OFFICE OF THE UNDER SECRETARY OF DEFENSE FOR RESEARCH AND ENGINEERING

Dr. NIKOLICH. Thank you, sir.

Chairman Langevin, Ranking Member Stefanik, distinguished members of the subcommittee, and Chairman Garamendi, I am pleased to be here today to discuss the Department's research and engineering activities related to the changing climate.

We recognize that the changing climate constitutes a national security issue with potential impacts to DOD missions, operational plans, and our infrastructure. Our work is focused on understanding and forecasting changes in the global operational environment to inform warfighter planning and operations. Our work also provides new technologies and insights for risk management.

The Office of the Under Secretary of Defense for Research and Engineering provides guidance, direction, and oversight on climate research and technology efforts that enable the military services to execute their missions. We engage in interagency and international partnerships on climate research. We work to mitigate the impacts of changing climate on DOD test ranges. We are also working to understand how the operational environment is changing.

To do this, we are utilizing modeling and simulation for prediction. Additionally, we are enhancing the Department's ability to sustain activities and operations through adaptation and resilience.

Service in OSD [Office of the Secretary of Defense] research activities are complementary, coordinated, and aligned with the unique capabilities and missions. For example, the Army is updating and expanding the DOD climate assessment tool for improved forecasting of operational risks to our infrastructure. The Navy is exploring new platforms for sustained operations—observations, excuse me, in the Arctic. They are also developing global weather, ocean, and sea ice prediction models.

The Navy and Air Force collaborate with interagency partners on the National Earth System Prediction Capability, which is the next generation of predictive models. The Air Force leverages national and allied partners' seasonal and climate model projections to provide planning products for the DOD and for the intelligence community. The Office of the Secretary of Defense's Strategic Environmental Research and Development Program is identifying new approaches for ensuring infrastructure resilience to the changing climate.

The Test Resource Management Center actively monitors potential impacts from weather and natural events at our test ranges. The Department's interagency and international partners are central to our work. We are engaged in a number of interagency committees through the White House Office of Science and Technology Policy such as the Subcommittee on Global Change Research. As a result of our engagement, DOD benefits from the significant R&D [research and development] investments across the Federal Government related to the changing climate. These committees also support international coordination and collaboration.

Thank you for the opportunity to be here today, and I look forward to your questions.

Mr. LANGEVIN. Thank you, Dr. Nikolich.

I want to thank all of our witnesses for your opening statements.

We are going to now move to questions; but before I do, I ask unanimous consent that non-subcommittee members be allowed to

participate in today's briefing after all subcommittee members have had the opportunity to ask questions. Is there any objection?

Without objection, non-subcommittee members will therefore be recognized at the appropriate time for 5 minutes. I now recognize myself for 5 minutes for opening questions, and will recognize members in the order of seniority according to their appearance before the subcommittee.

Ms. Langan-Riekhof and Mr. Tipton, I would like to refer back to this year's Worldwide Threat Assessment and the quote that global environmental degradation, as well as climate change, are likely to fuel competition for resources, economic distress, and social discontent through 2019 and beyond.

First of all, do you agree the administration's Worldwide Threat Assessment? And also, I want to say that if you agree, then what regions of the world should we be watching most closely for climate change-driven instability?

Ms. LANGAN-RIEKHOF. Chairman, thank you for that question.

As the National Intelligence Council takes lead with the worldwide threat testimony, and my unit actually has responsibility for the climate analysis that goes into it. So we just very recently have been looking at last year's testimony as we prepare for next year's testimony, and we continue to agree with that analytic assessment. There are a range of places to look at as far as where we might see climate stresses that could lead to some type of conflict.

One place, or one type of area, in particular, will be areas where there are potential water conflicts or water disputes. To date, water has not led as a single cause for any conflict between two nations. That said, as we move forward, and there are increasing droughts and there are increasing strains on water resources which supply more than one nation, I think those are areas that we need to be watchful for. Those are, in particular, in the Middle East, Northern Africa, as well as in South Asia where areas have experienced extreme drought. Water supplies are going to be challenging going forward, and we already are seeing that those are areas where they, you know, that could be an area of increasing tension.

That is just one example.

Mr. LANGEVIN. Thank you. Thank you.

Mr. Tipton.

Mr. TIPTON. Mr. Chairman, thank you.

We agree with Maria's characterization of the problem. Some of the specific areas that we pay attention to that we know are potential hotspots are Sub-Saharan Africa, where they are particularly vulnerable to climate variability, where droughts, floods, cyclones, desert desertification, can cause potentially agricultural yield losses up to more that 20 percent. So we fully support and concur with Dr. Langan-Riekhof's assessment, and monitor the same areas.

Russian impact on water supplies going to the Crimea, there are a variety of areas around the world—South Asia—that we pay attention to, but we really take the lead from the IC in helping us understand those global strategic implications.

Mr. LANGEVIN. Thank you.

I guess maybe to drive into that, dive in just a little further, the assessment also states that heat waves, droughts, and floods, combined with poor governance practices, are increasing water and

food insecurity in the world. The assessment specifically mentions Egypt, Ethiopia, Iraq, and Jordan.

Can you discuss further implications of social unrest, migration, and inter-state tension within these nations? Anything else you want to expand upon?

Ms. LANGAN-RIEKHOF. I think it is important to remember when we think about the causes of conflicts or internal instability that for almost any of the ones we are talking about, it is hard to narrow it down to a mono-cause. It is compounding strains. Climate, extreme weather events, often tend to be that threat multiplier in these cases. But for a decade now, we have been watching some of the implications of extended drought in the Middle East. We have had 5 years of drought conditions in Central America, which has challenged agricultural production.

So, again, I am going back to water issues; but when communities are strained by water, we see depleted crop production. We see issues of internal migration and families moving into urban areas, increasing the strain on cities and government provisions. And in countries where there are cases of corruption or poor government services, that just kind of ratchets up the possibility of greater instability.

Mr. LANGEVIN. Thank you.

So, Ms. Langan-Riekhof and Mr. Mercado, the administration's Worldwide Threat Assessment states also that diminishing Arctic sea ice may increase competition, particularly with Russia and China, over access to sea routes and natural resources. Can you—I know you touched on this in your opening statements, but can you further characterize Russia and China's behavior in the Arctic?

And, moreover, in March, before the Senate Armed Services Committee, the EUCOM [United States European Command] commander testified that operational plans have been changed to respond to Russian movement of weapon systems to exert influence over the Arctic. And I wanted to ask: Are we postured sufficiently to counter Russian moves to exert control over the region?

Maybe we will start with Mr. Mercado, and then we will go——

Mr. MERCADO. Chairman, as I said in my opening statement, great power competition focused on Russia and China is of great concern for us. As we watch what Russia is doing, how they are modernizing their ports, putting missile systems, systems—modernizing their airfields so they can base aircraft out of that, and how they are treating countries that want to transit the North Sea Passage, asking, making them or demanding that they ask for permission, maybe use their icebreakers and elements like that, we are concerned.

When we see China, who is not an Arctic nation, deploy research vessels up there, engage with various countries, not directly with the countries, but through other contacts, and based on my experience, looking now how—what their behavior brought us in the Pacific, in the Western Pacific and the South China Sea and their track record, so we are concerned with some of their activities up there.

When we look at our posture in the Arctic, especially the northern warning center that we have that is aging in—was built in the 1950s, I know that us and Canada are looking at options, alterna-

tives to modernize that, but not just for that warning piece, but also all the future threats like hypersonics, missiles, and things like that.

So the Arctic has the attention of both the northern—NORTHCOM [U.S. Northern Command] commander, General O'Shaughnessy, as well as the EUCOM commander, General Walters. We always do our planning by doing an intelligence assessment of the environment. So, we update all our plans based on the environment and how that could change, the intel assessment, and then adjust our plans accordingly, sir.

Mr. LANGEVIN. Thank you, Mr. Mercado.

Ms. Langan-Riekhof, do you want to comment, please?

Ms. LANGAN-RIEKHOF. I agree with Mr. Mercado's statements. I think we need to remember that Russia views the Arctic as an essential element of its national sovereignty. Just looking at its coastland, Russia's total Arctic coastline is 24,000 kilometers; and we have watched Moscow seeking to project greater influence in the Arctic through many of the things Mr. Mercado mentioned: infrastructure development, refurbishing its military facilities, training, deployments.

You know, Russia is concerned about foreign influence. It is investing and increasing its commercial activities as sea ice declines. So, yes, this is an area of concentration for the Russians.

Mr. LANGEVIN. Thank you.

The ranking member is now recognized.

Ms. STEFANIK. Thank you.

The Department has recently increased training activities in the Arctic, or near-Arctic environments, with exercises like Trident Juncture. What impact have these exercises and the development of an Arctic Strategy had on the Department's operational concept development, and what does the Department plan on doing differently and, broadly, how does OSD integrate climate science and policy into the development of our military policy?

Mr. Mercado, I will ask that to you.

Mr. MERCADO. Thank you, Ranking Member.

I think Trident Juncture, along with a number of activities that we have embarked since the Arctic Strategy, as we get into implementation and part of that implementation is enhancing our Arctic operations and an example of that is just last month, where the 2d Fleet deployed a maritime op center to Iceland, and then deployed four ships up there. And we are learning there is nothing like taking ships in a very harsh climate and learn the impact to all our weapons systems, the communications up at that area of latitude, and then also, the resiliency we have for our sailors in that environment. If you look on the other coast where up in Alaska, we do a number of training events, again, to understand the effects of the cold, harsh climate on our operations.

So, I think since the Arctic Strategy, we have made a concerted effort to learn and assess gaps in our training; and we will also learn from our allies and partners as well who have much more experience and expertise in operating in that climate.

Ms. STEFANIK. I would be remiss if I didn't add, you mentioned Alaska, but one of the most effective and useful cold weather training facilities is at Fort Drum in my district, where we have signifi-

cant capabilities, and are able to develop that skill set that is going to be an issue that we have to tackle as we look to the Arctic.

I yield the balance of my time to Mr. Gallagher.

Mr. GALLAGHER. Thank you.

Mr. Mercado, we have seen public reporting that China is pursuing small-scale floating nuclear reactors to support the artificial island bases in the South China Sea. Is DOD aware and tracking those developments?

Mr. MERCADO. I am not familiar with that specific report. I am tracking some of the nuclear efforts of Russia in the Arctic, but I am not aware of that specific report in the South China Sea.

Mr. GALLAGHER. Interesting.

Where—I guess then, more broadly, where does DOD stand in terms of developing similar technology, nuclear micro reactors? Basically the idea is that particularly in permanent bases, given the vulnerabilities inherent to the grid, vulnerabilities for cyber attack, that it would make sense to develop an alternative source of energy and that there is promising technology in the pipeline right now. I would just be curious, anyone on the panel take a swing, where we stand on developing that technology relative to our competitors, China and Russia in particular.

Dr. NIKOLICH. Let me respond to that.

So the Department is looking at technologies having to do with what we call micro reactors in two formats: One of which is to serve as an energy source for our fixed locations where there are challenges to normal provision of electricity and energy, and those instances where a transportable capability might have application in operational settings. And so we are looking at both of those, and both at in terms of exploring the technologies and considering applications.

Mr. GALLAGHER. What—I mean, what can we do in Congress to help expedite that process? I mean, the risk is that the Chinese gained a market advantage in these technologies. We have seen some of the capital in the private sector go to China actually and that we may not be able to catch up. Are there things here we can do in Congress to help DOD explore those options more expeditiously——

Dr. NIKOLICH. I would say——

Mr. GALLAGHER [continuing]. That are promising? I mean——

Dr. NIKOLICH. I beg your pardon?

Mr. GALLAGHER. Do you think they are promising? I mean——

Dr. NIKOLICH. Yes, I think the thing that I would say is that in our pursuit of this, we are doing these activities in strong partnership with the Department of Energy. I think there is a general belief that this segment of capability could constitute a new area of revival for commercial providers and so there are—there are hopeful prospects in this area. I think, probably, the best I could say in terms of what we would ask is, for the request we put forward, if they could be supported by the Congress.

Mr. GALLAGHER. Thank you.

And I thank the ranking member for her indulgence.

Ms. STEFANIK. I yield back.

Mr. LANGEVIN. Mr. Garamendi is now recognized for 5 minutes.

Mr. GARAMENDI. Thank you, Mr. Chairman, and thank you for the courtesy of joining you on this hearing.

I believe all of us are aware of the work that this subcommittee has done over the last several years in addressing the climate change issue. Much of that work found its way into the Readiness Committee mark, and just quickly share some of what was put into the mark, and I see some colleagues here who are aware of it.

What we wanted to do in the mark was to make sure that the 1,100 facilities that the Department of Defense—mark, actually more than a mark, it is going to be up for a vote this afternoon or this evening—that the Department of Defense and its 1,100 facilities take into account climate change and the impacts that it will have, or could have, from natural events, hurricanes, tornadoes, floods, deluges, whatever, oh, rising sea level, also.

And so there is a requirement that the major bases have a master plan within the next 3 years to deal with this. And also, the Department of Defense will have limited authority, spending until there are plans that actually carry out climate resiliency. So that will be for all of the new MILCON [military construction] programs.

And then the structures themselves will be redesigned to the maximum energy conservation and resiliency for earthquakes or tornadoes or floods or whatever it happens to be, and we want to make sure—and this is a pilot program. This may fit in with what Mr. Gallagher just brought up and that is energy-sufficiency, microgrids and energy conservation on all of the bases. And it will be $133 million special fund to carry out these projects.

And, finally, we expect there will be power outages. Welcome to California, and PG&E [Pacific Gas and Electric Company], and Southern California Edison. So there will be black startup programs on key bases to test it, along with the microgrids that go with it.

Much of what has been discussed here is also in the bill, having to do with icebreakers; and, again, this committee has played a major role. The first heavy icebreaker is in process of construction, early stages design, and it is nearly complete in construction soon but it is one of at least four that we need to deal with the challenges of the Arctic which have been discussed here in some depth.

Beyond that, we do know that we are going to have to deal with sea level rise; and it turns out that a lot of our bases are on the shore. We have considered two different options for the largest military shipyard in the world, Norfolk. One option is to figure out which seawalls might fit. The other is to outfit everybody with waders. One was those two things are going to have to be done because we are already seeing the sea level rise there.

Beyond that, just down the line, what else should we be doing? Let's start with design side of it and, quickly, I don't know, 30 seconds apiece. What else should we be doing?

Dr. NIKOLICH. Sir, I would like to maybe bring out a few points about what we are doing in terms of basic research and understanding that can support the direction you are describing. I would illustrate it maybe with a particular case.

As we think about the receding of ice in the Arctic, we concern ourselves with the idea of thawing permafrost and research that is

going on having to do with an understanding of what that means in terms of our ability to support structures and their design, and, along with that, how we might be able to instrument some of those—put instrumentation on some of those structures so that we can determine the onset of stresses that we could take steps to correct before catastrophic damage is effected.

Mr. GARAMENDI. Thank you.

Sir.

Mr. TIPTON. So, Mr. Garamendi, first, this is far beyond my area of expertise but from the Defense Intel perspective, obviously we will follow the lead of our partners in research engineering and A&S [acquisition and sustainment] in terms of how we protect our intelligence capability systems, buildings, and installed capacity that we have around the world and in the United States. And we will, you know, continue to work but the broader implications of those changes and what that means for the nations around the world and the implications, then, for us.

Mr. GARAMENDI. If I might interrupt quickly.

Mr. TIPTON. Sure.

Mr. GARAMENDI. Actually, you are going to be involved in some of this, some of your assets, for anticipatory—where the fires are going, where the flood might be. There are observation platforms that are available, and in the legislation this year, we do move those, make those assets available for climate-related challenges.

Mr. MERCADO. Sir, having watched the events where our bases have felt the extreme effects of weather, and also most of my time has been in the Pacific watching Guam take some severe hits time and time again, and us failing to improve the infrastructure and learn from that, this is hugely important from my standpoint in strategy, plans, and capability. What we need to be able to do is to generate forces, and the key to generating our forces is our bases and so to the degree that we can base, train, mobilize, operate, and generate those forces to where they need to be, you know, it is hugely important. So, all those things are much needed.

Mr. GARAMENDI. We will be looking at the new construction projects on Guam, specifically for that Category 5 typhoon.

Ms. LANGAN-RIEKHOF. For the intelligence community, over the past year, we have taken steps to increase intelligence sharing and collaboration across the IC and beyond. There has been the establishment of the Environmental Security Working Group in the spring of this year. It was sponsored, you know, by the NIC, the National Intelligence University, and the Civil Applications Committee to work across the community, to share information, to make sure we are bringing in the most recent and scientific research on climate, and to look at the broad range of risks that affect all of the agencies and the whole of the U.S. Government. That is a program that now is meeting monthly, and is exploring the range of implications.

Mr. GARAMENDI. If I might, Mr. Chairman, a final 30-second comment, the work that you did, your subcommittee has done in the previous years informed us that the Department of Defense is a major consumer of fossil fuels of all kinds; and as a result of your work in the NDAA [National Defense Authorization Act], there will be encouragement for energy conservation on the bases, on the fa-

cilities, in the ships, planes, and so on and so forth, all of that to deal with the emissions issue.

Really, thank you, and thank you so very much for the time and the work your committee has done over the many years. We will continue to take your work and forward it into Readiness.

Mr. LANGEVIN. Absolutely. Thank you, Chairman Garamendi. I want to thank you for your leadership on the Readiness Subcommittee and the time and attention you have put into the climate change issue, and it has been great working with you and particularly on the joint hearing that we recently held together between this subcommittee and the Readiness Subcommittee. So thank you for that.

The Chair now recognizes Mr. Crow for 5 minutes.

Mr. CROW. Thank you, Mr. Chair.

And thank you to all the witnesses for joining us today on the important topic.

Mr. Mercado, beginning with you, over the past several months, I have been holding roundtables with senior leaders from the Department of Defense and Department of Energy and outside experts to explore the importance and challenges associated with the effects of climate change on our operational capabilities and our installations. As the threat from extreme weather due to climate change continues to grow, we are asking our troops to fight in increasingly extreme environments.

At the policy and planning level, how is the Department adapting its strategy to reflect the changing environment we are seeking our soldiers to operate in? And what additional authorities are necessary to adapt at the rate that we are seeing ourselves having to adapt?

Mr. MERCADO. Sir, I think we start with implementing the Arctic Strategy that we developed and published. So it is one thing to develop the strategy. It is the other thing, the next step is to implement it; and from that, the ways we have identified to do that is to first build the awareness of not only the Arctic, but also trying to predict severe climate.

Also enhancing our operations, like I said earlier, about increasing the operations that we conduct, either in the Arctic or in other places with regard to it, so we can learn and make our systems more resilient, not only the ones that are ashore, but also our ships and also our service members.

And then the other part is much broader and applies to the Arctic and the Arctic Strategy about working with our partners. Some of the partners, like I said earlier, have very large expertise in operating in these environments; and we can learn from them as we work to them to increase that skill set.

Mr. CROW. A follow-on question for the whole group, whoever wants to chime in on this one. You know, you represent various agencies, you know, departments, but there is a lot of our government that has equities in the Arctic. Which of those are not represented here today that you think are relevant for this discussion, and do you have challenges with siloing? Are people kind of within agency silos, and are there things that Congress can do to help break down any barriers that might exist and increase collaboration across the Federal Government?

Dr. NIKOLICH. If you would allow me, maybe one—speak to one aspect of that, and that has to do with in our research and technology area. We are participants in a number of committees under the White House's Office of Science and Technology Policy that are specially designed to help foster our collaboration and sharing of information, knowledge, models, and all the rest across the interagency to the benefit of all executive branch members.

It is worth pointing out that those are brought together actually as a statutory requirement. So, as a result of action on the part of Congress, those committees have come together.

Mr. CROW. And is that operating effectively in your view?

Dr. NIKOLICH. Yes, sir.

Mr. CROW. Okay. Would the others like to chime in on that?

Mr. TIPTON. Not on that, Mr. Crow, not on that specific subject, but related to your question about siloing and breaking down of the barriers between some of the components—if you look at what has happened over the last 10 years within defense intel and the intelligence community, the changes that have been implemented in terms of forcing that integration across the various practitioners within those very broad enterprises have been very, very effective.

Dr. Langan-Riekhof mentioned the ESWG, the Environmental Security Working Group, that is an example of a fairly new entity that brings together all these various components to cause to happen that information sharing that you need to have to have that collaborative effect and break down those stovepipes. So I think in a nutshell, we have made tremendous progress in enabling those crossflows of communication within the Defense Intel Enterprise, the IC, and our relationship with academia, with all the other folks that have a role in this kind of activity.

Mr. MERCADO. Sir, the value of plans is it helps break down stovepipes. Like I said, planning starts with intel, preparation of the environment, and the assessments. And then it is critical to planning, once you have developed that plan, is the posture associated with executing that plan because the plan is no good unless the bases and the posture that you have in the region can support that. So that brings all of the other DOD components, and all the services who have to execute the plans and all the training and force development and all that that entails.

So at least with the strategy and how we—we have a resurgence of planning in the Department, I think that is helping to bring different parts of the Department together.

Mr. CROW. I am out of time.

So, Mr. Chair, I would yield back.

Mr. LANGEVIN. I thank you, Mr. Crow.

We are going to do a second round. So, if you have further questions, you will be able to get them in then.

So I recognize myself for 5 minutes.

Dr. Nikolich, what modifications would we need to make for our forces to be able to operate in newly opened Arctic? I know we have touched on some of this already, but what changes would we need to—modifications would we need to make? And are surface fleets capable of operating in subfreezing waters? And do we have sufficient polar satellite coverage?

Dr. NIKOLICH. Let me respond in this way: With respect to operational capabilities, it is really outside my area of expertise, but I would say that with respect to developing the understanding to inform how we need to go about doing that and the capabilities that are necessary, the Navy is, of course, leading the way in gathering the necessary data to go into our modeling capabilities to project what conditions we are likely to face, and, in turn, then provide a basis for determining specific capabilities.

With respect to observational capabilities, I beg your pardon, but I can't speak in particular depth, but I can say that two things are happening: the first of which is we are drawing not only on our own capabilities and sensors that are being emplaced, but also drawing from the sensing capabilities within the civil component of our space capabilities. And through our partnerships, we can look for opportunities for our partners to collaborate, in terms of providing data sources for our models.

Mr. LANGEVIN. Thank you. Anything else, Mr. Mercado? Mr. Mercado, do you want to chime in about modifications that we need to make?

Mr. MERCADO. Yes, Chairman. I think, based on the nature of the environment, much of the operations are conducted by the Air Force, and also the submarines. As you know, we conduct ICEX [Ice Exercise] there. So recently now, I am interested to see the feedback from the Navy's efforts to start operating more in that environment.

So I think we have much to learn on the surface side, but we have very good engineers that can adapt, like we have adapted to the dust in the Middle East. And as we operate more up in the Arctic, we will learn more to make our surface force more resilient.

Mr. LANGEVIN. Would this include additional expansion of a base and operating facilities?

Mr. MERCADO. Well, sir, part of the Arctic Strategy talks about reviewing infrastructure required to project power and operate in the Arctic. So we have some work to do to do that assessment on the requirements for a strategic port up in Alaska or other places that will help enable those operations.

Mr. LANGEVIN. Very good. Thank you.

With that, unless there is any other comment, I will yield to the ranking member.

Ms. STEFANIK. Great. One final question. Dr. Nikolich, while this isn't specifically a DOD issue, I did want to get—I did want to raise this for your awareness and get your feedback.

We have heard from the commercial sensing industry about a concern about the development of 5G networks, especially those networks that will operate in similar bands to the same bands used by weather satellites to detect water vapor, potentially compromising weather forecasting. This might be for you or Mr. Mercado. Is this something that DOD is aware of, and are there any research efforts to mitigate this potential challenge?

Dr. NIKOLICH. I am sorry, but I am not knowledgeable on that specific topic, but that I am not knowledgeable off the top of my head doesn't mean that we are not aware of it. So if you will allow me, I would prefer to take that for the record and give you a proper and thorough answer on that.

Ms. STEFANIK. Sure. I appreciate. I will take that response for the record and look forward to it. Mr. Mercado, do you have anything to add?

Mr. MERCADO. Nothing other than I know that 5G is a concern. But we can take that question for the record.

Ms. STEFANIK. Okay. With that, I yield back.

[The information referred to can be found in the Appendix on page 51.]

Mr. LANGEVIN. Thank you, Ranking Member.

One final question I had, Ms. Langan-Riekhof and Mr. Mercado will probably be the appropriate ones to address this, but could you please describe U.S. engagement with the Arctic Security Forces Roundtable, and what are the priorities that have been discussed?

And are there participating nations—are the participating nations concerned about expanding Chinese influence in the region? We have talked about Chinese influence in the region already, but anything else you want to expand upon there, but if you take the Arctic Security Forces Roundtable.

Mr. MERCADO. Mr. Chairman, I am not familiar with that roundtable, but I can reiterate my concern about China's operations in the Arctic region. But my main concern is, as I watch their activity, as we watch their activity is to avoid another episode similar to the South China Sea, because I would think that somewhere in the past, as China started to reclaim those features, we had an opportunity probably to check that behavior. So what I am hoping is that we don't make the same mistake as we monitor China's activities in the Arctic.

Mr. LANGEVIN. Thank you. Do you have anything to add, Ms. Langan-Riekhof?

Ms. LANGAN-RIEKHOF. I would also have to take back that question on the security forces in the Arctic. I don't have any information on that. But we are closely tracking what China is doing in the Arctic: its commercial activities, its shipping activities, and also, many of its public statements it has made about its Arctic policy, calling itself a Near-Arctic state, and introducing the Polar Silk Road and linking it to the Belt and Road Initiative. So we are following it closely. I don't have any specific information.

Mr. LANGEVIN. If you can look into that and get back to us, that would be helpful. Thank you.

With that last question, I will yield to Chairman Garamendi for 5 minutes.

Mr. GARAMENDI. Thank you, Mr. Chairman.

First of all, we are not going to be very successful in the Arctic, and probably anywhere else where there is an ocean, unless we become a signatory to the Law of the Sea. It is a major problem that we have in the South China Sea. It is certainly going to be, and is today, and will be in the future, even a greater problem in the Arctic. For example, Russia is claiming everything to the North Pole and beyond. We have no pushback because we have no status, failing to be a signator to the Law of the Sea.

Secondly, for the near term, probably for the next decade, we will not be able to operate on the surface in the Arctic Ocean with naval ships unless somebody starts putting heavy plate on one side—on both sides of the ship. So we are going to have to depend

upon icebreakers, of which we only have one heavy. We will have two heavies soon. We are going to have to deal with this.

And for the Department of Defense, this is a major and very, very important budget item. You can talk forever, but until there are icebreakers or naval ships are built for ice, which nobody has planned yet, we are going to depend upon the icebreakers displaying American power in the Arctic.

Final point—I don't know if there is any final here, but next point: Climate refugees. It was spoken to earlier by the panel. The climate refugee issue is of profound importance. We see them today. We talk about this mostly in the Sahel of Africa, but the issue of immigration from Central America is very, very much a climate issue, and we are talking climate refugees along with violence. And so, we are seeing this and we need to plan for that, not just for the military, obviously for immigration issues here in the United States, but also for dealing with our military operating, as an example, in the Sahel of Africa.

So those are issues. I would love to have a comment on any of these subjects: Law of the Sea, what we are really going to be able to do for the next decade in the Arctic as a military power. And finally, you have already talked about climate and climate refugees. Any comment you would like to make in the next 2 minutes.

Mr. MERCADO. Sir, on the Law of the Sea, it has been an issue. And in all the international forums that I have experience with or been involved with, our partners bring it up and they challenge us. And what I tell them is that, yes, I mean, we are not a signatory, but always judge us by our actions. Judge us that we always abide by the Law of the Sea. All our forces do that. So while we understand that there are issues with us being a signatory, that hasn't happened yet, but, again, judge us by how we comport ourselves on the high seas. And that is the approach we have to take at this point.

With regard to icebreakers, absolutely, in the Department we support and we need icebreakers. So we support the Coast Guard effort to build up the icebreaker fleet. And that would be helpful for operations, sir.

Mr. GARAMENDI. Yield back.

Mr. LANGEVIN. Okay. Thank you, Chairman Garamendi. I want to thank our witnesses again for your testimony here today. Again, I will reiterate that I would have liked to have had the more senior leadership here testifying. They originally said that you would be the best people to come and testify, but this is also a senior leadership policy issue that we are going to have to confront and deal with for the foreseeable future.

And so the senior leaders at the Department are going to have to become more expert on this issue and this topic themselves, as they are going to have to spend more and more time dealing with the effects of climate change, the consequences, both in planning, operations, in mitigating the effects of climate change on our bases, our military planning; again, the consequences of climate change worldwide as a result of, again, desertification or climate drought, where we might be asked to respond, again, on just a whole host of levels.

So I hope in the near future that we will have senior leadership here as well testifying on this topic who themselves will be up to speed on and expert in these topics as well. They are going to need to be, going forward.

So, with that, I know members had some questions that had asked for information to be returned to us on the record. I would ask that you respond to those questions expeditiously.

And, with that, I want to thank you again for your testimony and the work you are doing in this area and many others. With that, the subcommittee now stands adjourned.

[Whereupon, at 3:46, the subcommittee was adjourned.]

A P P E N D I X

DECEMBER 11, 2019

PREPARED STATEMENTS SUBMITTED FOR THE RECORD

DECEMBER 11, 2019

Opening Statement Chairman James R. Langevin
Intelligence and Emerging Threats and Capabilities Subcommittee

Climate Change in the Era of Strategic Competition

December 11, 2019

The subcommittee will come to order.

Welcome to today's hearing on Climate Change in the Era of Strategic Competition. Today we will receive testimony on the impacts of climate change—from extreme weather events to changing arctic ice coverage—on U.S. national security and how the Department's strategies and plans are addressing those critical challenges.

Climate change appears to present three types of threats: direct threats to U.S. military installations, our ability to train and execute various missions, and more indirect geopolitical unrest. The IETC Subcommittee held a joint hearing with the Readiness Subcommittee exactly 8 weeks ago today, to discuss the resiliency of military installations to emerging threats, including climate change. Today's follow-on hearing is meant to highlight the threat that climate change presents geopolitically; home in on the Department's efforts to plan for the emerging operating environment; and hear about innovative approaches and technologies to address and ameliorate the threat.

The Armed Services Committee—and this subcommittee in particular—has placed considerable focus on the intersection of climate change and geopolitics, and how that intersection implicates our strategic and operational planning.

There is broad bipartisan agreement that climate change is going to have significant implications for our defense posture. I want to be clear—the purpose of this hearing is not to debate the relative criticality of climate change as compared to other emerging threats, but rather to understand how climate change shapes the threats we are already watching. How has Russia changed its posture in the High North to take advantage of an increasingly ice-free Arctic? How does drought in Iran inform the decision-making of its leaders? Are violent extremist organizations, like Boko Haram, taking advantage of water scarcity to increase their power and influence? In what parts of the world do we expect climate stresses to drive instability?

In January 2016, the Department assigned responsibilities for addressing the major risks to readiness and the vulnerabilities posed by climate change. Today, we will here from individuals from the organizations tasked with executing those responsibilities.

Dr. Neil Tipton is the Director of Defense Intelligence in the Office of the Under Secretary of Defense for Intelligence (USDI). The USDI is tasked with overseeing the planning, organizing, coordinating, and balancing of climate change for all DoD intelligence. The organization also coordinates with the DNI on all related risks, potential impacts, considerations, and effects of altered operating

environments related to climate change and environmental monitoring.

Ms. Maria Langan-Riekhof is the Director of the Strategic Futures Group at the National Intelligence Council within the office of the DNI. Ms. Langan-Riekhof's organization is responsible for the Global Trends strategic assessment that outlines how key trends and uncertainties—including climate change—should inform the National Intelligence Community and senior leaders.

Mr. Victorino Mercado is the Acting Assistant Secretary of Defense for Strategy, Plans and Capabilities in the Office of the Under Secretary of Defense for Policy (USDP). The USDP is tasked with developing policies, plans, programs, forces and posture needed to implement the DoD strategy, including adapting actions to increase resilience to climate change.

Finally, Dr. Milan Nikolich is the Director of Defense Research and Engineering for Research and Technology in the Office of the Under Secretary for Research and Engineering (R&E). The office of R&E is tasked with overseeing "defense-related research in climate science for the development of approaches and technologies that reduce risk and promote mission execution.

While I would have preferred to have your senior leadership testify before this subcommittee, I want to thank you all for your willingness to speak on this critical topic.

Statement for the Record

Maria Langan-Riekhof

Director, Strategic Futures Group

National Intelligence Council

Office of the Director of National Intelligence

FOR A HEARING ON

"Climate Change in the Era of Strategic Competition"

BEFORE THE

HOUSE ARMED SERVICES SUBCOMMITTEE ON INTELLIGENCE AND EMERGING THREATS AND CAPABILITIES

U.S. HOUSE OF REPRESENTATIVES

Wednesday, 11 December 2019

Chairman Langevin, Ranking Member Stefanik, and distinguished members of the Committee, thank you for the opportunity to discuss the Intelligence Community's (IC) assessment of the national security implications of climate change.

Changing climate is just one of a multitude of factors—alongside things like demographics, economic and political factors, and technology—that the IC considers when it examines global strategic trends and the potential threats they pose to US national security. The IC does not assess the direct effects of climate change on the US homeland, nor does it evaluate the science behind the scientific reports. To inform our judgments regarding the national security implications of climate change, we rely on reports produced by US federal science agencies, peer-reviewed scientific journals, and reports from international scientific organizations.

Climate Trends and National Security

These scientific assessments, which indicate that Earth's atmosphere and oceans are undergoing a long-term warming trend, raise critical national security questions. Studies indicate rising temperatures can amplify extreme events such as heatwaves, heavy precipitation, storm surges, droughts, wildfires, and some tropical cyclones. Other effects, which already are in evidence, include rising sea levels, melting glaciers and ice sheets, thawing permafrost, soil degradation, ocean acidification and deoxygenation, animal and plant species redistribution, coral bleaching, and changes in ocean and atmospheric circulations. Complexities in Earth's systems, uncertainties in modeling, and the unpredictability of human choices—including the level of greenhouse gas emissions—make it difficult to project when and where specific disruptive events and other climatological changes will have the most significant national security effects.

The IC assesses that such effects from climate change almost certainly will have an increasingly significant direct and indirect effect on the social, political, economic, and security challenges faced by the United States and other countries during the next few decades. The combination of other environmental stresses and human activities makes it challenging to discern the national security implications of climate change in isolation. In many cases, climate change is likely to exacerbate existing stresses, such as water or food shortages that worsen social and political conditions in a country.

The effects of climate change are likely to compound other dynamics, including:

- Straining physical infrastructure.
- Contributing to instability in some countries.
- Driving disruptive human migration.
- Exacerbating tensions over resources.
- Increasing competition in the Arctic.

The IC assesses that, for the next several years, the security risks for the United States linked to climate change will arise primarily from distinct extreme weather events that are compounded by worsening pre-existing problems, such as water and food insecurity, around the world. During the

next 20 years and beyond, we expect that the greatest threats will arise where multiple extreme weather events converge, driven by both climate change and these underlying climate stressors.

Straining critical physical infrastructure:

The collective effects of climate change are likely to directly damage and strain overseas infrastructure critical to US national security interests. The expected more frequent and intense heat waves and extreme precipitation events will hinder economic development by threatening vital energy resources in some strategically important countries in the developing world.

- A warming climate will significantly increase energy demand in some countries at the same time that extreme weather and sea-level rise threaten energy supplies. High temperatures weaken generation and transmission efficiency by straining cooling systems and power lines, while more extreme precipitation patterns will reduce hydroelectric power production.
- Physical damage to coastal transportation networks and ports also is likely to affect trade and economic activity.

Contributing to instability:

In the coming two decades, the IC assesses that an increasing number of countries will encounter climate-related hazards—such as extreme weather events, drought, heat, or infrastructural damage—that will stress their capacity to respond, cope, or adapt. We already have seen water crises exacerbate social unrest in and emigration from fragile states in the Middle East and North Africa, such as Syria and Libya, in part by aggravating the effects of other factors, such as preexisting socioeconomic grievances and ineffective government institutions, according to a joint UN-World Bank study. With continued rising temperatures, more countries are likely to face such challenges with greater frequency, increasing the risk of unrest, migration, and interstate tension.

- Countries with weak political institutions, poor economic conditions, or other existing risk factors, such as political strife, probably will be the most vulnerable to climate-linked instability or migration and would be the hardest pressed to respond to and recover from a crisis.
- Twenty-six of the 39 countries assessed by a 2018 USAID-funded academic study to have the highest or high state fragility also have a large number of people or a large proportion of the population facing high risk from the effects of climate change. Burma, Egypt, India, Nigeria, and Democratic Republic of Congo have the greatest number of people in highly exposed areas.

Increasing human migration:

In some regions, climate-related hazards are likely to contribute to migrations that overwhelm host governments and populations and exacerbate existing social and political tensions. As sudden extreme weather—such as floods, heatwaves, and severe tropical storms—becomes more frequent, the number of displaced people almost certainly will increase, with effects felt particularly in regions that are unaccustomed to or unprepared for such events and areas that have already absorbed large influxes of migrants, such as the Levant, Sahel, and Europe. Rising sea levels and unexpectedly large storm surges could threaten small island states and low-lying coastal regions, including many megacities, with flooding and saltwater contamination of freshwater.

- The World Bank estimates that significant levels of warming could push tens of millions of people in Sub-Saharan Africa, South Asia, and Latin America to migrate within their countries

by 2050. These migrants are likely to move from rural to urban areas, possibly spurring a reduction in agricultural production and food security in affected countries, while further straining the provision of services in urban areas.

Exacerbating tensions over resources:

Disputes over land and water resources increasingly trigger social violence and internal conflict, particularly when they build on preexisting social and political grievances. More frequent extreme weather events, ranging from droughts to intense rainfall, would significantly threaten agricultural production and increase food price volatility. As the climate changes, disputes over water and access to arable land are likely to grow, prompting more such local conflicts. Moreover, scarcer land and water resources could spur speculation by international investors, pricing out local communities and increasing tensions.

- In 2018, disputes over access to water and grazing land were a factor that fueled conflict between farmers and herders in Mali that reportedly killed several dozen people. Also in 2018, water protests in southern Iran turned violent when security forces opened fire on demonstrators.

- Ocean warming and acidification are likely to adversely affect marine fish populations, particularly in East Asia and in the North Sea. Disputes over fishing rights and access have become major points of contention for countries that rely heavily on fishing for food or income, increasing the incentive for illegal and unregulated fishing, particularly as species migrate outside of established fishing grounds because of warming oceans.

- Food prices will likely rise as long-term climate effects—such as more very hot days and nights and changing precipitation patterns—compound already worsening constraints on food production caused by local deficiencies of land, water, and energy supplies. Heatwaves and reduced precipitation threaten livestock and reduce fertility, pasture yields, milk production, and disease resistance.

Increasing challenges in the Arctic:

The IC assesses that changing conditions in the Arctic will have significant security, economic, and social implications for both Arctic and non-Arctic states. Scientific research by the National Oceanic and Atmospheric Administration states that warming rates in the Arctic are more than twice the rate of the rest of the Earth, which means the Arctic could be free of ice cover in the summer as early as 2030. An increasingly navigable Arctic makes the region more consequential for both economic and security reasons. The Arctic has historically been characterized as a region of international cooperation and low geopolitical tension, but growing involvement by Arctic and non-Arctic states and increasingly accessible resources and sea routes could upend these dynamics.

- Additionally, thawing permafrost will imperil an estimated two-thirds of today's Arctic civilian and energy infrastructure by mid-century.

Recent actions by Beijing and Moscow suggest that both capitals are preparing for a future in which the Artic is warmer and more accessible.

- Diminishing sea ice is already enabling Russia and China to explore use of the newly opened sea routes to accelerate extraction of fossil fuels, potentially further harming the fragile northern ecosystem. While large-scale exploitation still faces commercial challenges, the Arctic could contain well over 90 billion barrels of oil, 1,700 trillion cubic feet of natural gas, and 44 billion barrels of liquid natural gas. In August, Russia's Lukoil and China's Chinaoil participated in the first sale and shipment of Arctic crude to Asia, transporting oil from Murmansk to Dongjiakou via an unusually ice-free Northern Sea Route (NSR).

- Russia and China are both increasing investment in the region. For example, Russia in 2017 pledged $2.7 billion to develop its continental shelf, and longer openings of the NSR could advantage Russian liquefied natural gas exports to Asian markets that US companies are also seeking to develop. China has been a leading investor in the Yamal natural gas project in the Russian Arctic. In January 2018, Beijing published an Arctic policy white paper in which it reiterated its claim to be a "near-Arctic state" and introduced the "Polar Silk Road", linked to its Belt and Road strategy. China has also launched two icebreakers, and its cargo ships are increasingly transiting the NSR.

- Russia is also taking actions that suggest it views the Arctic as an emerging theater of military competition. While Moscow's Ambassador-at-Large for International Cooperation in the Arctic recently described the Arctic as "a territory of peace, constructive interaction, and neighborliness," Russian media continue to showcase recapitalization of Arctic military power. October 2019 press reporting from Norway noted that deliveries of goods to Russia's Arctic military bases this year have increased by 200 percent.

China's role in climate change:

China seeks to boost its image as a leader in combating climate change, despite its role as the largest carbon emitter and its continued support for high-emissions development globally. Given its massive energy demands, China's energy decisions are likely to drive the direction of greenhouse gas emissions for decades to come. The country remains the world's largest coal consumer and is building mostly low efficiency, coal-fired power plants abroad. Although China played a pivotal role in 2015 to broaden the scope of commitments by developing countries under the UN Framework Convention on Climate Change process, Beijing is likely to continue to avoid energy decisions that impose significant economic costs.

- China, however, seeks to establish itself as a renewable energy superpower and touts its more than $100 billion in annual investments in green technologies. China is now the world's largest producer, exporter, and installer of solar panels, wind turbines, batteries, and electric vehicles, and controls 29 percent of global renewable energy patents.

- Beijing has also announced plans to increase the share of Belt and Road Initiative projects dedicated to renewable energy and sustainable infrastructure in coming years as it seeks to bolster its environmental reputation abroad.

Climate geoengineering:

Unilateral efforts by countries or groups to test or deploy geoengineering—a largely theoretical field exploring how to moderate the effects of climate change through methods such as injecting aerosols into the stratosphere or chemically altering the reflectivity of clouds—have the potential to heighten tensions among states. The authority of actors to conduct such activities with global implications would be in dispute. Further, it may be impossible to fully attribute outcomes to geoengineering activities, rather than from natural variability or other emissions of greenhouse gases.

Global governance and multilateral responses:

Political disputes among nations and various stakeholders are hampering international policy-driven efforts to reduce emissions. Some adversely affected countries and interest groups may take their grievances outside of the UN Framework Convention on Climate Change-led process and seek redress through international judicial mechanisms. For example, since 2011 several small island states have proposed seeking an advisory opinion from the International Court of Justice related to climate change.

Terrorist recruitment

Terrorist groups have exploited natural disasters and water and food shortages in some countries, including Iraq, Nigeria, Pakistan, Somalia, and Syria, to boost recruitment and support among local populations.

Closing:

Climate change and its resulting effects have wide-ranging implications for national security, presenting risks and challenges for the US. The IC plays an important role in identifying and analyzing these implications for policymakers. Thank you for the opportunity to appear before the Committee today to share our assessments, and I look forward to your questions.

Maria Langan-Riekhof is the new director of the Strategic Futures Group at the National Intelligence Council, leading the Intelligence Community's assessment of global dynamics and charged with producing the quadrennial Global Trends product for the incoming or returning administration. She has spent more than 27 years in the intelligence community as both a senior analyst and manager, serving at the CIA and on the NIC. She brings a background in Middle East studies and has spent more than half her career analyzing regional dynamics. Her leadership roles include: Chief of the CIA's Red Cell, founder and director of the CIA's Strategic Insight Department, and research director for the Middle East. She was one of the DNI's Exceptional Analysts in 2008-09 and the Agency's fellow at the Brookings Institution in 2016-17. She is a member of the Senior Analytic Service and the Senior Intelligence Service and hold degrees from the University of Chicago and the University of Denver.

Joint STATEMENT FOR THE RECORD OF

Mr. Vic Mercado, Performing the Duties of the Assistant Secretary of Defense for Strategy, Plans and Capabilities,

Dr. Milan "Mitch" Nikolich, Director of Defense Research and Engineering for Research and Technology,

And

Mr. Neill Tipton, Director of Defense Intelligence (Collections and Special Programs),

before the

HOUSE ARMED SERVICES COMMITTEE

SUBCOMMITTEE ON INTELLIGENCE, EMERGING THREATS AND CAPABILTIIES

on

CLIMATE CHANGE IN THE ERA OF STRATEGIC COMPETITION

December 11, 2019

As cited in the Department of Defense's report, "Effects of a Changing Climate to the Department of Defense" provided to Congress in January, 2019, the dynamics of a changing climate have the probability to impact DoD missions, operational plans, and installations in the coming years. The Department takes the effects of this evolving challenge seriously, as evidenced by the range of related partnerships and research undertaken over the last few years.

Our 2018 National Defense Strategy prioritizes long-term strategic competition with great power competitors by focusing the Department's efforts and resources to: 1) build a more lethal force, 2) strengthen alliances and attract new partners, and 3) reform the Department's processes.

Making progress on these lines of effort requires DoD to ensure the Joint Force is ready and resilient for current and future operations and activities impacted by a variety of emerging operational challenges and conditions, including those posed by weather and natural events. To that end, DoD factors in the effects of the environment into its mission planning and execution to build resilience. The areas we must be most prepared for include impacts on Departmental facilities from events such as drought, flooding, and wildfires; and on changing operational demands, such as increased geopolitical instability and increased competition in the Arctic. Our partners and colleagues in the Intelligence Community (IC) assist in identifying a number of related indirect and direct effects, primarily overseas. While the IC examines the vulnerabilities of a changing climate along with other key factors when assessing threats to U.S. national security, it does not assess the direct effects of climate change on the U.S. homeland, nor does it evaluate the scientific basis for scientific reports. To manage all of the aforementioned issues, in January of 2016 the Department issued Department of Defense Directive 4715.21, "Climate Change Adaptation and Resilience." This directive assigns responsibilities to many levels and components of the Department, seeking to incorporate climate considerations into planning for infrastructure and operations in order to assess and manage risks associated with the impacts of a changing climate.

Policy

The Department of Defense (DoD) fulfills its role to deter war and ensure our nation's defense by remaining ready and able to adapt to a wide variety of security challenges. The effects of a changing climate are one such challenge that has potential impacts on DoD missions, planning, and operations.

Foremost among these considerations is the Department's approach to addressing strategic competition in the Arctic, which necessarily takes into account the region's changing physical environment. Due to the diminishing sea ice, the Arctic's accessibility is growing and opening the door to new economic opportunities. Strategic competitors are taking advantage of the Arctic's increased accessibility to expand their activities in the region. Thawing permafrost and coastal erosion adversely affect some defense infrastructure, complicating the Department's posture in the region. As well, the Arctic will continue to be a harsh and demanding operating environment for the Joint Force.

The 2019 DoD Arctic Strategy is anchored in the priorities of the National Defense Strategy, focusing on great power competition as the principle challenge to long-term U.S. security and prosperity. It describes the Department's desired end state for the Arctic as "a secure and stable region where U.S. national interests are safeguarded, the U.S. homeland is defended, and nations work cooperatively to address challenges."

The immediate prospect of conflict in the Arctic is low, but the Department maintains a clear-eyed approach to the differing effects of competitors' activities on U.S. interests in the region and beyond. Russia's military investments in the Arctic contribute to its territorial defense, but may have strategic implications for future access to the region. China is seeking a role in Arctic governance, despite it having no territorial claims in the region, and there is a risk that China may repeat predatory economic behavior in the Arctic that it has exhibited in other regions, to further its strategic ambitions.

The DoD Arctic Strategy establishes three defense objectives that guide the Department's approach to addressing strategic competition in the Arctic.

1) Defend the homeland;

2) Compete when necessary to maintain favorable regional balances of power; and

3) Ensure common domains remain free and open.

The Department is taking steps to enhanee the Joint Force's ability to operate in the Arctic and project power through the region and beyond, both independently and in cooperation with allies and partners. Enhanced domain awareness, regular exercises and training, interoperable supporting infrastructure and extreme cold weather resilience are mutual areas of development we are pursuing with allies and partners. The changing environment in the Arctic highlights the need to maintain the full range of navigation and overflight rights guaranteed by international law to both military forces and lawful commerce.

Finally, our network of allies and partners are a key strategic advantage for the United States in the Arctic; they are the cornerstone of the Department's strategic approach to the region. Six of the seven other Arctic nations are either NATO Allies or are NATO Enhanced Opportunities Partners. Our allies and partners are highly capable and proficient in the Arctic region's operating conditions, and they share the United States' interest in maintaining the international rules-based order – including in the Arctic region. Defense cooperation with allies and partners complements wider U.S. Government Arctic cooperation in forums such as the Arctic Council (which excludes defense and security from its mandate).

Although the Arctic presents unique challenges to the Department, we believe we have the right strategic approach, and a strong network of allies and partners, to navigate this changing environment.

Intelligence

While the Defense Intelligence Enterprise (DIE) executes many roles within the Department, none is more vital than direct intelligence support to our warfighters. In order to stay ahead of all potential threats, we are working several initiatives within the DIE. Foremost, we are ensuring safety of navigation, monitoring geopolitical boundaries for disputes, and expanding partnerships.

Safety of Navigation. The Department of Defense maintains worldwide maritime and aeronautical safety of navigation databases, products, and services in support of US and partner warfighters. Impacts to the shorelines of the world requires continuous data collection and updating of Safety of Navigation products - most notably around areas concerning national security interests (e.g, ports and military installations) – and accounting for impacts to U.S. strategic assets and their ability to project power.

Geopolitical Boundaries and Disputes. The warming of the Arctic is leading to an increase in access to previously inaccessible areas and a corresponding increase in military & commercial activity above the Arctic Circle. To provide policy makers and warfighters with a better common operating picture in these areas, the DIE and the broader national Intelligence Community is conducting a review and detailed analysis of foreign maritime claims in the Arctic region where some states assert overlapping entitlements. While climate change may not necessarily impact the analysis of the claims, the warming of this region will increase human activity and lead to a potential for increased disputes to access and resources. Therefore, developing a more comprehensive common operating picture including competing maritime claims is paramount to providing clarity in potential disputes.

Partnerships. The DIE recognizes that it is only one stakeholder within this topic. In addition to traditional intelligence, the DIE relies on a substantial amount of scientific reports to

provide accurate assessments for decision makers. As such, the DIE is involved in a number of partnerships with academia and other Federal science agencies through a variety of channels such as working groups, grants, and so on. This enables the DIE to work in an innovative environment with America's talented scientists on extremely complex models, some which provide DoD with the ability to view changes in topographic features over time to enable predictive analysis.

Research and Engineering

The Office of the Under Secretary of Defense for Research and Engineering (USD(R&E)) ensures the technological advantage of the American warfighter. To this end, USD(R&E)'s responsibilities on climate issues fall into three areas: (1) providing guidance, direction, and oversight on climate research and technology efforts that enable the military Services to execute their missions;[1] (2) engaging in interagency and international fora on climate issues, to include the interagency sub-committee on Global Change Research; and (3) mitigating the impacts of climate issues on DoD test ranges and ensuring their availability for military training, exercises, test, and evaluation.

Guidance, Direction, and Oversight of DoD Climate Science Research

DoD's research, development, testing, and evaluation (RDT&E) efforts are tightly focused on understanding and forecasting changes in the global operational environment to inform warfighter planning and operations. Accordingly, the majority of the Department's research investments in this area reside in the Services and are tailored to their individual needs.

[1] Includes the range of activities on climate issues, from ensuring the readiness of enablers such as training ranges to direct operational support.

Within the Navy, scientists are developing methods to enable long-term observational capabilities in the Arctic, as well as developing global weather, ocean, and sea ice prediction models. This will ensure the Navy has the capability to operate and compete in the Arctic environment. The Army assesses future risks to DoD facilities and installations through the application of climate modeling and current information on weather patterns. Army research is also providing new approaches to address risks to DoD Arctic facilities posed by thawing permafrost and enabling an understanding of how equipment and systems will operate in extremely cold environments. The Air Force, Navy, and Army collaborate in the development of atmospheric modeling and weather forecasting models to predict how weather may impact military operations.

Within the Office of the Secretary of Defense, the Strategic Environmental Research and Development Program (SERDP) is funding research initiatives to determine the effect of sea level rise on military installations and develop risk mitigation strategies to increase infrastructure resilience.

More broadly, the Department supports basic research in the areas of meteorology, physical oceanography, biogeochemical sciences, terrestrial science, and polar science and engineering. The Department also has ongoing efforts through its Small Business Innovation Research (SBIR) program that include developing: data analytics platforms to anticipate where environmental stressors are likely to contribute to societal instability; re-chargeable heat storage systems for cold climate operations; and biotechnology solutions to food insecurity.

Collectively, these investments are ensuring the Department's ability to assess, anticipate, and adapt to our changing climate in a manner that enables sustained, global military capabilities to meet the objectives of the National Defense Strategy.

Interagency and International Engagement

The Department's interagency and international partners are central to our ability to manage climate risks. As the DoD Principal to the Subcommittee on Global Change Research (SGCR), R&E ensures the Department's subject matter experts in climate science are fully engaged with their interagency colleagues and rapidly benefit from the data, knowledge, and tools that result from this program.

The Department leverages the research activities of interagency partners with a primary mission relevant to climate issues, including the National Oceanic and Atmospheric Administration (NOAA), the National Aeronautics and Space Administration (NASA), and the U.S. Geological Survey (USGS). Through this collaboration, the Department gains access to standardized data sets that increase the precision and timeliness of DoD's climate forecasting and analysis tools.

Climate issues also pose challenges for U.S. allies and partners. DoD has active bi- and multi-lateral engagements with other Arctic nations,[2] works closely with our NATO colleagues on climate research, and collaborates via The Technical Cooperation Program (TTCP)[3] on global change RDT&E.

DoD Test Ranges

DoD's Test Resource Management Center (TRMC) ensures the Department's testing and evaluation capabilities meet the current and future needs of the warfighter. As part of this mission, TRMC actively monitors potential impacts of weather and natural events, as well as

[2] Including Canada, Denmark, and Norway
[3] Canada, United Kingdom, New Zealand, Australia.

recovery efforts at ranges providing test and evaluation support to the Department. TRMC works with the ranges to build awareness of potential impacts, climate science advances, and potential mitigation approaches to assist the Services in developing resilient mitigation and recovery strategies.

Conclusion

Climate and environmental resilience efforts span all levels and across the entire Department. Additionally, resources for assessing and responding to climate impacts are provided within existing DoD missions, funds, and capabilities and subsumed under existing risk management processes. The Military Departments provide most of the resources for on-the-ground activities in the Geographic Combatant Commands and the efforts of our Combat Support Agencies can also not be understated. Finally, this is an evolving issue that we will continue to monitor to ensure the Department is appropriately prepared to address the effects of a changing climate on future operations and activities.

Victorino G. Mercado
Performing the Duties of Assistant Secretary of Defense for Strategy, Plans, and Capabilities

Vic Mercado is Performing the Duties of Assistant Secretary of Defense for Strategy, Plans, and Capabilities. He is responsible for advising the Secretary of Defense and the Under Secretary of Defense for Policy on national security and defense strategy; the forces, contingency plans, and associated posture necessary to implement the defense strategy; nuclear deterrence and missile defense policy; and security cooperation plans and policies. Mr. Mercado ensures that the Department's program and budget decisions support and advance senior DoD leaders' strategic direction, especially as articulated in defense planning guidance.

Mr. Mercado graduated from the U.S. Naval Academy in May 1983 with a Bachelor of Science in Mathematics and Computer Science. Mr. Mercado holds a master's degree in systems technology in Joint Command, Control and Communications from the Naval Postgraduate School in Monterey, California.

Prior to his appointment as the Deputy Assistant Secretary of Defense for Plans, Mr. Mercado served in the U.S. Navy for 35 years retiring in November 2018. His service at sea as a surface warfare officer included assignments aboard USS Leftwich (DD 984), USS Valley Forge (CG 50), USS Antietam (CG 54), and USS Curtis Wilbur (DDG 54), culminating with command of USS Decatur (DDG 73) during an accelerated deployment with the John C. Stennis Battle Group in support of Operation Enduring Freedom – Afghanistan and United Nations sanctions on Iraq. He subsequently commanded Destroyer Squadron 21 with additional duties as sea combat commander for the John C. Stennis Carrier Strike Group.

Ashore, he completed a tour with the Navy's engineering and acquisition community as the command, control, communications and intelligence warfare systems engineering manager for the AEGIS Program Manager (PMS 400), served as an action officer and vice director, Navy Staff for Staff Operations and Special Events, Office of the Chief of Naval Operations (OPNAV) N09BX, as the national defense legislative fellow for Sen. Edward M. Kennedy and later led the Commander's Action Group for the Commander, U.S. Pacific Fleet. On the Joint Staff, he served as the joint staff lead in the Joint Chiefs of Staff Strategy Group; as assistant deputy director, Global Strategic Partnerships (J-5); as executive assistant to the director, Strategic Plans and Policy (J-5); and as executive assistant to the Chairman of the Joint Chiefs of Staff. Following his tour on the Joint Staff, he served as the military assistant to the deputy secretary of defense.

Mr. Mercado's flag officer tours include deputy director, Surface Warfare Division (N96B) and Director, Assessments Division (N81) on the staff of the chief of naval operations, and as vice director, Strategy, Plans and Policy (J5) at U.S. Central Command. Afloat, he commanded Carrier Strike Group 8, including the transition from the Dwight D. Eisenhower to the Harry S. Truman Carrier Strike Group. His final assignment on active duty was the director, Maritime Operations for U.S. Pacific Fleet.

Dr. Milan Nikolich
Director, Defense Research and Engineering for Research and Technology

Dr. Milan "Mitch" Nikolich is the Director of Defense Research and Engineering for Research and Technology and serves as the principal advisor to the Under Secretary of Defense for Research and Engineering on all of the Department's research and technology investments. He also serves as the Mission Area Advisor for National Defense Strategy technology development implementation and oversees activities in Microelectronics, Cyber, Quantum Science, Directed Energy and Machine Learning/Artificial Intelligence. He establishes the Department's annual strategic Science and Technology investment strategy, issues policy and guidance for aligning the Department's Science and Technology investment to this strategy, and conducts reviews to ensure progress toward the Department's goals.

Dr. Nikolich also serves as the Department's chief steward and advocate for defense laboratory infrastructure and scienee and technology workforce. He serves as the lead for ensuring the Department of Defense maintains its technological advantage through strategic research and technology investments. He also has responsibilities for the establishment and implementation of protection methodologies to mitigate the risk of loss of critical technologies to determined adversaries.

Dr. Nikolich has held senior positions with SAIC, CACI, National Security Research Inc., Defense Group Inc., W.J. Schafer Associates and served in the Physics Division of Los Alamos National Laboratory. He also served on the Congressional Commission to Assess the Threat to the U.S. from Electromagnetic Pulse Attack and was a part-time faculty member at George Washington University. He was technical contributor to the Strategic Defense Initiative, the establishment of the Department's Countering Weapons of Mass Destruction program, the advancement of the U.S. nuclear weapons program and has been a member of a number of U.S. arms control delegations.

Dr. Nikolich earned a Bachelor of Science degree Electrical Engineering in 1981, a Master of Science degree in Electrical Engineering in 1983, and his Doctor of Philosophy in 1985 in Electrical and Computer Engineering, all from the State University of New York at Buffalo. His area of emphasis was in plasma devices and pulsed power systems.

Neill Tipton
Director for Defense Intelligence, Collection and Special Programs

Mr. Neill Tipton serves as Director for Defense Intelligence, Collection and Special Programs, Office of the Under Secretary of Defense for Intelligence.

Mr. Tipton has been with the Office of the Under Secretary of Defense for Intelligence since 2007. He has held a broad range of leadership positions for the office: Director, Clandestine Operations, Global Access, and Mission Integration and Director, GEOINT and SIGINT Support; Director, Information Sharing and Partnership Engagement and IPT Lead for Information Sharing and Collaboration for the SECDEF's ISR Task Force; Deputy Director, SIGINT and Cyber; and as OUSDI Senior Advisor for Technical Collection.

During his tenure with OUSDI, he also served on detail as Deputy Director, Defense Technology Integration Program Office and to the Office of the Director of National Intelligence, as the Chief of the Collection Integration Group.

Prior to OUSDI, Mr. Tipton worked for the National Geospatial-Intelligence Agency. While with NGA he held leadership positions principally focused on improving NGA's integration with other elements of the Intelligence Community and the DoD.

Mr. Tipton has more than 38 years of experience in the intelligence community, with extensive expertise in the management and conduct of SIGINT, MASINT, and GEOINT operations. His background includes a wide range of intelligence activities, including Army and joint operations, National intelligence operations at NSA and NGA, all-source analysis, and extensive oversight and policy activities.

Mr. Tipton retired from the US Army in 1999 after twenty years as a SIGINT specialist with assignments in Latin America, Germany, Korea, Operation Desert Storm, and multiple CONUS locations, including two tours at NSA.

WITNESS RESPONSES TO QUESTIONS ASKED DURING THE HEARING

DECEMBER 11, 2019

RESPONSES TO QUESTIONS SUBMITTED BY MS. STEFANIK

Mr. MERCADO. I defer to Dr. Nikolich and OUSD(R&E) on this issue. [See page 20.]

Dr. NIKOLICH. Yes, the Department is aware of this issue and we have been engaged in ongoing interagency discussions on the matter. While we have not conducted detailed studies to assess the impact of 5G signals upon weather satellites, the Department has a long history of active research into technologies that have the potential to apply to this issue—specifically, beamforming technologies to concentrate the transmitted signal directly onto the receiver in a way that minimizes stray signals and communication methods that function using the lowest possible signal levels. We use these technologies to minimize adversary detection and to gain efficiencies but they can also potentially mitigate against the possibility of the interference you have referenced. [See page 20.]