

**DEPARTMENT OF DEFENSE AUTHORIZATION FOR
APPROPRIATIONS FOR FISCAL YEAR 2019 AND
THE FUTURE YEARS DEFENSE PROGRAM**

HEARINGS

BEFORE THE

**COMMITTEE ON ARMED SERVICES
UNITED STATES SENATE**

OF THE

ONE HUNDRED FIFTEENTH CONGRESS

SECOND SESSION

ON

S. 2987

TO AUTHORIZE APPROPRIATIONS FOR FISCAL YEAR 2019 FOR MILITARY
ACTIVITIES OF THE DEPARTMENT OF DEFENSE AND FOR MILITARY
CONSTRUCTION, TO PRESCRIBE MILITARY PERSONNEL STRENGTHS
FOR SUCH FISCAL YEAR, AND FOR OTHER PURPOSES

**PART 4
AIRLAND**

FEBRUARY 7; APRIL 18, 2018



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**DEPARTMENT OF DEFENSE AUTHORIZATION
FOR APPROPRIATIONS FOR FISCAL YEAR
2019 AND THE FUTURE YEARS DEFENSE
PROGRAM**

WEDNESDAY, FEBRUARY 7, 2018

U.S. SENATE,
SUBCOMMITTEE ON AIRLAND,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

ARMY MODERNIZATION

The subcommittee met, pursuant to notice, at 3:35 p.m. in Room SR-222, Russell Senate Office Building, Senator Tom Cotton (chairman of the subcommittee) presiding.

Subcommittee Members present: Senators Cotton, Wicker, Sullivan, Sasse, King, McCaskill, Donnelly, Warren, and Peters.

OPENING STATEMENT OF SENATOR TOM COTTON

Senator COTTON. The hearing will come to order.

Good afternoon, everyone. This is the first hearing of the year. Today, we will be talking about Army modernization. It is an important topic in its own right. We always want to make sure our men and women in uniform have the best arms and equipment on the battlefield, but it is also an opportunity to think about the long-term because we cannot arm ourselves against the threats of the 21st Century until we are clear about what those threats are.

I want to say the National Security Strategy and National Defense Strategy got it just about right. We are in an era of renewed great-power competition, which means Russia and China are the gravest threats we face today.

Now, is Islamic terrorism still a threat? Yes, of course. The development of Iran and North Korea's nuclear programs, are those deeply alarming? Yes, they are. But China and Russia are building advanced new weapons systems to rival our own capabilities, and in some cases, we are already falling behind those countries, and it would be much worse were they to ally against us.

Two years ago, Lieutenant General H.R. McMaster told this committee the Army was already outranged and outgunned, so just imagine what has happened in the last 2 years. I am glad to see the Army has made progress on some of these challenges.

Since last October, Army leadership, especially Deputy Secretary McCarthy, have taken great strides in improving our acquisition policy. They have announced a modernization command. They have

created several cross-functional teams to manage key programs. This is all very good. I know the committee would very much like to hear more about the status of some of these programs, in particular, long-range fires, integrated mobile air defense, next-generation ground combat vehicles, the future of vertical lift, mobile communication networks, the Distributed Common Ground System-Army, active protection systems, and alternative force designs. Now, we certainly want to hear about programmatic timelines. We are especially interested in figuring out how we can get these capabilities into the hands of our soldiers.

The National Defense Authorization Act asked the Army to come up with a strategy for modernization, so we want to know, what is that strategy? What do you think the battlefield of tomorrow looks like? What does mobile combined arms maneuver look like in 10 years? How can we integrate the Army within the joint force battle space?

To help answer these and other questions, we are joined today by a panel of distinguished general officers, Lieutenant General Joe Anderson, the deputy chief of staff, G-3/5/7; Lieutenant General John Murray, deputy chief of staff, G-8; Lieutenant General Paul Ostrowski, the principal military deputy to the assistant secretary of the Army for acquisition, logistics, and technology, and the director of Army Acquisition Corps; and Major General Robert Dyess, acting director of the Army Capabilities Integration Center.

Gentlemen, thank you all for being here. We look forward to your testimony.

Senator King?

STATEMENT OF SENATOR ANGUS S. KING, JR.

Senator KING. Mr. Chairman, thank you for holding today's important hearing. I would also like to welcome our witnesses. I look forward to your testimony and deeply appreciate your service to our country.

Last month, as the chairman noted, Secretary Mattis released the National Defense Strategy that focused on the reemergence of long-term strategic competition, a major change in our strategy, the central challenge now facing the United States. To that end, countering the threat that is posed by China and Russia is now the primary focus for the Department, and this threat is substantially different in many, many ways from the counterterrorism fight that our military has been engaged in for the past 16 years.

With the refocus on great-power competition, we have to ensure that our soldiers are trained and equipped for conflict across the full spectrum of operations. As such, today's subcommittee hearing on Army modernization is timely and necessary.

I want to say from the outset that I want to commend the senior leadership of the Army for the recent efforts to ensure that the Army delivers new technology and platforms to the force in a more effective and timely manner. Under the leadership of Secretary Esper, Secretary McCarthy, General Milley, and General McConnell, the Army is pursuing a new modernization strategy focused on six major modernization priorities that the chairman mentioned, long-range precision fire, next-generation combat vehicles, future

vertical lift, upgraded mobile communications network, enhanced air and missile defense capabilities, and improved soldier lethality.

To support this effort, the Army has established cross-functional teams designed to break down acquisition stovepipes and expeditiously field new weapons systems expeditiously. I emphasize that term. While effective modernization strategies are always critical to the success of our soldiers, the current effort by the Army is vitally important in supporting the new National Defense Strategy.

If U.S. Forces become engaged in a future fight with a peer adversary, it is likely they will face serious anti-access/area-denial threats, advanced weapons technology, as well as hybrid warfare tactics. As this committee continues to review our National Defense Strategy and begins evaluating the fiscal year 2019 budget request in the coming weeks, I hope our witnesses today will address what modernization investments they believe are necessary to ensure the Army prevails against our most capable adversaries.

Fielding new weapons platforms and upgrading existing systems, however, while critical to our national security, is not the only way to deter our adversaries. We must always also acknowledge that our competitors are capable of causing great harm to our country without directly engaging our forces in combat. For example, Russia interfered in our most recent presidential election, and continues to try to influence our domestic politics, while at the same time it redraws boundaries in Eastern Europe, destabilizes its neighbors, and undermines democratic values. Therefore, as the Army pursues its modernization strategy, I want to know from our witnesses if the Army is considering different operational concepts about warfare in the future given the new emphasis on great-power competition.

In addition, resources are not unlimited. The Army has to prioritize investments and make tough allocation choices. Due to the spending caps driven by the Budget Control Act and the lack of predictability provided by 2-year budget deals, which we devoutly hope we will have in the next 24 hours, the Army has focused on rebuilding full-spectrum readiness and maintaining end-strength levels. I welcome any comments from our witnesses on how the Army plans to balance restoring readiness while ensuring our soldiers have the capabilities necessary to fight future battles against advanced adversaries.

Finally, expanding the competitive space against our adversaries cannot be accomplished solely by the Department of Defense. The National Defense Strategy is explicit on this point, stating that it requires the combined actions of the U.S. interagency to employ all dimensions of national power. Therefore, as this committee considers the fiscal year 2019 budget request for defense, we must remember that increased defense spending should be complemented by increased spending in other core elements of national power. We need an effective Department of State, Central Intelligence Agency, Department of Homeland Security, Department of Justice, and other agencies that can ensure our strategy is capable of countering our adversaries and accomplishing our national objectives.

Thank you, Mr. Chairman, for calling this hearing. I look forward to hearing from our witnesses.

Senator COTTON. Thank you, Senator King.

Gentlemen, we have received your written statement. We will enter that into the record. I understand now that you each have a brief testimony as well. We will start with Lieutenant General Anderson and move down the row.

**STATEMENT OF LIEUTENANT GENERAL JOSEPH ANDERSON,
USA, DEPUTY CHIEF OF STAFF, G-3/5/7, UNITED STATES ARMY**

Lieutenant General ANDERSON. Thanks, Chairman Cotton, Ranking Member King, and distinguished Members of this committee. Thanks for the opportunity to testify on the state of the U.S. Army. I appreciate your support and demonstrated commitment to our Army and look forward to discussing with you the ongoing need to invest in Army modernization and its critical relationship to building and maintaining readiness.

My experience has allowed me to witness significant lasting detrimental effects to Army readiness and modernization caused by the Budget Control Act and continuing resolutions. The abrupt implementation of fiscal year 2013 sequestration significantly impacted every aspect of our Army. Sequestration compelled the Army to take drastic measures in training and readiness and delayed modernization. Continuing resolutions compound resourcing solutions and greatly affect the Army's ability to generate readiness and execute our modernization strategy.

Last year, I discussed that our competitors were studing our doctrine, making revisions to their own, and rapidly modernizing their militaries, all of which threaten America's interests. Today, the United States Army remains second to none, but while we have been building short-term readiness to remain engaged in counterterrorism and stability operations, our adversaries have made significant gains, which means that overmatched concerns persist, as you both just mentioned. We now face the prospect of fighting threats in complex anti-access/area-denial environments. The forces our adversaries are building often rival and in a few instances surpass our current capabilities.

Failure to modernize will undoubtedly intensify the significant risk to our Army. Modernized force structure and operating concepts are critical to the Army's ability to employ equipment effectively to meet our nation's threats. This will ensure a trained and ready Army that has capable capacity to meet current and future challenges and prevail against the full range of military operations. Modernization ensures the readiness of the total force on future battlefields and the conflicts against near-peer adversaries.

The Army invested additional end strength authorized by the fiscal year 2017 NDAA to increase personnel levels for deploying units. We also added a small number of units to fill capability gaps to help meet combatant commanders' operational and contingency demands. We are piloting new operating concepts such as multi-domain battle and cyber force teams that will make our combat formations more capable on the modern battlefield. The Army will continue to apply additional end strength if authorized in fiscal year 2018 to readiness and critical shortfalls like security force assistance, air defense, long-range fires, and additional cyber capabilities.

Readiness remains our number-one priority, but modernization is a priority as well. Operating under continuing resolutions and the looming pressures of sequestration affects readiness, increases risk, and creates delays in getting American soldiers the weapons and tools they need to fight and win our nation's wars. Stable and predictable long-term funding is necessary if the Army is to continue to build and sustain current readiness while shaping the future force.

We thank you for the unwavering support of our outstanding civilians and the men and women in uniform and the families who support them. I look forward to answering your questions. Thank you.

Senator COTTON. General Murray?

**STATEMENT OF LIEUTENANT GENERAL JOHN M. MURRAY,
USA, DEPUTY CHIEF OF STAFF, G-8, UNITED STATES ARMY**

Lieutenant General MURRAY. Chairman Cotton, Ranking Member King, and distinguished Members of the Subcommittee on Airland. On behalf of the Army Secretary, the Honorable Mark Esper and our Chief of Staff General Mark Milley, we all very much look forward to discussing Army modernization with you today and addressing some of the issues you raised in your opening statements.

The Army has reached an inflection point, and it is the same thing I told you last year, that we can no longer afford to choose between near-term readiness and modernization. Specific to modernization, we can no longer afford to choose between incremental upgrades to existing equipment and developing new capabilities. We have definitely reached a point where we have got to be able to do both. The Army's focus on the demands of ongoing campaigns combined with constrained resources and an industrial-age organizational model have slowed, deferred, and in some cases halted the development of new capabilities.

Meanwhile, as General Anderson mentioned, our adversaries have or are quickly attaining a competitive advantage. We believe that the President's commitment to restoring the military will be clearly evident in the budget request, especially in regards to Army readiness and modernization. If appropriated, we believe it will be a very good start towards reversing the historical and significant shortfalls in modernization funding. However, one year will not by itself reverse the trend. We must have sustained, predictable, and adequate funding over the long term to allow us to develop an effective plan to reduce current and future risk, while making the most effective use of the valuable resources entrusted to us.

In fiscal year 2019, we plan to selectively upgrade the equipment that is critical to near-term readiness, focus our science and technology and research development test and evaluation funding on the six Army modernization priorities you mentioned, and begin the development of the equipment we will need to regain and sustain overmatch against a peer threat. The American people expect their Army to win, and meeting this expectation requires that the Army regain and maintain overmatch against any peer threat.

We urge Congress to provide fiscal stability at a sufficient level so that we can maintain our current warfighting readiness, while

simultaneously building a more modern and capable force for the future. I would like to thank you and the entire committee for your unwavering support of the men and women of the United States Army, our Army civilians, and our families. Thank you, and I look forward to your questions.

Senator COTTON. General Ostrowski?

**STATEMENT OF LIEUTENANT GENERAL PAUL A. OSTROWSKI,
USA, PRINCIPAL MILITARY DEPUTY TO THE ASSISTANT SEC-
RETARY OF THE ARMY (ACQUISITION, LOGISTICS, AND
TECHNOLOGY) AND DIRECTOR OF THE ARMY ACQUISITION
CORPS**

Lieutenant General OSTROWSKI. Chairman Cotton, Ranking Member King, and distinguish Members of the Subcommittee on Airland, thank you for the invitation to meet with you and discuss our re-modernization. I want to applaud this subcommittee and the committee as a whole for your focus over the past several years on acquisition reform. Your direction and support have made a substantial difference for the Army. Some of the great examples include enabling the use of other transactional authority, raising the acquisition simplified threshold from \$150,000 to \$250,000, pushing major defense acquisition programs down to the services, starting to get after the Competition in Contracting Act, or CICA reform, just to name a few.

Still, more must be done. For example, the simplified acquisition threshold should be raised to \$500,000, providing even greater streamlining and allowing us to keep pace with threat.

With regard to mid-tier acquisition for rapid prototyping and fielding addressed in section 804 of the fiscal year 2016 NDAA, we are hampered by the requirement to complete fielding within 5 years as opposed to achieving initial operational capability within 2 or 3 years, which is more consistent with our multiyear resourcing process. We ask that you consider modifying this language.

Section 807 in the fiscal year 2017 NDAA must be modified or repealed. Although major acquisition programs have been delegated to the services, section 807 still requires the Deputy Secretary of Defense approval for establishing program targets for these programs, which is contrary to streamlining the process. It adds back layers of bureaucracy.

CICA reform could go much further than the pilot established in the fiscal year 2018 NDAA. Hundreds of millions of dollars are wasted due to lost time and effort each year, while the number of successful protests against DOD remains exceedingly low. Penalties leveled should make industry think twice about whether to protest when they know the chance of winning is small to nonexistent. Penalties should be scaled to the contract value, thereby not disadvantaging small businesses from putting forward a legitimate protest when warranted. Further, we need to eliminate the automatic stay as a protest is resolved. In almost all circumstances, GAO [Government Accountability Office] bid protests result in a stay in performance, thereby impacting mission and delaying new contracts by many months.

Last, one of the most essential needs of the Army right now is C.R. reform. We have seen no movement on the fiscal year 2018 appropriations bill since November of 2017 when the Army received the last of subcommittee marks, which was the SAC-D. Right now, as a result of the prolonged C.R. for the fiscal year 2018, DOD is not allowed to begin new start efforts until a budget is passed while simultaneously not being able to procure quantities greater than the prior year's purchase without an approved anomaly. This double jeopardy is placing 16 new start efforts on hold and 10 production rate increases are being capped at their fiscal year 2017 rates, thereby thwarting the Army's ability to take advantage of quantity discounts, as well as economic-order quantities.

So how do we fix this? The answer might be quite simple. Allowing the services to execute at the lowest mark of the four committees during C.R.'s until a budget is passed. If this was in place today, we could have been moving forward with our budget in 2007 after the SAC-D mark in November.

Mr. Chairman and distinguished Members of the subcommittee, thank you for your steadfast and strong support of the outstanding men and women of the United States Army, our Army civilians, and their families.

This concludes my opening remarks, Mr. Chairman. I look forward to your questions.

Senator COTTON. General Dyess.

**STATEMENT OF MAJOR GENERAL ROBERT M. DYESS, JR., USA,
ACTING DIRECTOR, ARMY CAPABILITIES INTEGRATION CENTER**

Major General DYESS. Chairman Cotton, Ranking Member King, distinguished Members of the subcommittee, thank you for the opportunity to speak with you today about the enduring need for Army modernization.

Our National Security Strategy states that we face simultaneous threats from different actors across multiple arenas, all accelerated by technology, and that the United States must develop new concepts and capabilities to protect our homeland, advance our prosperity, and preserve peace. The National Security Strategy also directs the Department of Defense to develop new operational concepts and capabilities to win without assured dominance in air, maritime, land, space, and cyberspace domains, including against those operating below the level of conventional military conflict. Operational concepts are important because they drive capability development and provide a basis for modernization necessary to overcome the challenges of a future conflict.

The National Defense Strategy emphasizes that concepts provide us the ability to anticipate the implications of new technologies on the battlefield, rigorously define the military problems anticipated in future conflict, and foster a culture of experimentation and calculated risk-taking. We have developed operational concepts to sharpen our competitive advantages, enhance our lethality, and shape our modernization strategy. The National Defense Strategy also reminds us that modernization is not just defined solely by hardware; it requires change in the ways we organize and employ forces.

Over the past year, the Army and the United States Marine Corps have developed the first iteration of the multi-domain battle concept, and now, in support of the National Security Strategy and the National Defense Strategy, the Army, in coordination with the Marine Corps, the Air Force, and Special Operations Command, we will develop the multi-domain battle concept in the next iteration. We want to address how the environment and adversaries of change, how adversaries systematically intend to accomplish their strategic ends, the specific problems adversaries pose to the joint force and partners, and systemic ways to compete with and, when necessary, defeat those adversaries.

The multi-domain battle concept builds on current service and joint doctrine. It aids the evolution of current doctrine to include not only those capabilities of the physical domains but also those of space, cyberspace, the electromagnetic spectrum, the information environment, and the cognitive dimension of warfare. It provides recommendations for capabilities, those that commanders might require to defeat an advanced enemy, and proposes a new framework for understanding the expansion of the 21st Century battle space. The multi-domain battle operational framework accounts for extended ranges and complex relationships, which accounts for all friendly and enemy capabilities across all domains and levels of command from tactical to strategic.

Based on our assessment of the projected operational environment, we have identified five first-order problems to U.S. Forces that must be addressed as we mature the multi-domain battle concept, which I will address in Q&A if you want to go there. We need a joint force that can credibly deter adversary aggression, defeat actions short of our conflict, deny the enemy freedom of action, overcome enemy defenses, control terrain, compel outcomes, and consolidate gains for sustainable results.

On a personal note, in a couple of months I am going to be retiring after 36 years of service, and I would like to thank the Members of the committee for taking care of our soldiers, sailors, airmen, and marines. I would also request a final push on the budget to provide for the common defense for our great nation.

Thank you for your continued support. I look forward to your questions.

[The joint prepared statement of Lieutenant General Anderson, Lieutenant General Murray, Lieutenant General Ostrowski, and Major General Dyess follows:]

JOINT PREPARED STATEMENT BY LIEUTENANT GENERAL JOHN M. MURRAY, LIEUTENANT GENERAL JOSEPH ANDERSON, LIEUTENANT GENERAL PAUL A. OSTROWSKI, AND MAJOR GENERAL ROBERT M. DYESS, JR.

INTRODUCTION

Chairman Cotton, Ranking Member King, distinguished Members of the Senate Subcommittee on Airland, thank you for your continued support and demonstrated commitment to our soldiers, Army civilians, families, and veterans. On behalf of our Army Secretary, the Honorable Mark Esper, and our Chief of Staff, General Mark Milley, we thank you for the opportunity to appear before you today. We look forward to discussing Army Modernization with you.

Modernization is critical to the future of our Army. For the last several decades, the U.S. Army possessed overmatch based on its qualitative edge in capabilities. It enabled our Army to defeat enemy formations, underpin credible deterrence, and serve as a critical pillar of Joint Force capabilities in all domains—air, land, mari-

time, space, cyberspace, and the electromagnetic spectrum. Now, a combination of strategic, technological, institutional, and budgetary trends places at risk the Army's competitive edge over peer adversaries in the next fight.

The Army has reached an inflection point: we can no longer afford to choose between improving our existing systems and developing new ones. We must do both. The American people expect their Army to win, and meeting this expectation requires the Army to maintain overmatch against emerging threats and adversaries. While we continue to work hard to improve our readiness, we now need to expand our focus on a dedicated and robust modernization effort. As you know one of the most critical elements in achieving this objective is sufficient resources. We believe that when you see the Fiscal Year 2019 Budget Request, it will be clear that the President is committed to restoring the military, especially in the case of equipment modernization.

Building on the Fiscal Year 2018 President's Budget, we believe this budget will continue to reverse the downward trend that has stifled Army modernization and serve as an important step towards expanding and maintaining overmatch. We will seek to employ these funds in the most efficient and effective manner by turning ideas into actions through continuous experimentation and prototyping, reforming our acquisition processes, leveraging technology, and improving training. This will ensure that future generations of American soldiers remain the most lethal fighting force in the world.

THE STRATEGIC ENVIRONMENT

The U.S. Army, as part of the integrated Joint Force and working with a capable network of partners and allies will continue to provide combat-credible land forces to protect the homeland, deter our adversaries, and if called upon, decisively win our Nation's wars. Today's national security environment is typified by the reemergence of long-term strategic competition with revisionist powers who use their position within the international order to revise international norms in their favor. The United States is being challenged to maintain dominance across domains, and both state and non-state actors are increasingly capable of threatening the U.S. Homeland. Rapid technological advancements put military and other disruptive technologies in the hands of both state and non-state actors.

China's expansive territorial claims as well as its investment in multi-layer Anti-Access/Aerial Defense systems strains international relations in the South China Sea. Additionally, China's economic resources and the government's ability to direct investments positions them to make rapid technological advancements especially in advanced computing, artificial intelligence, robotics, and "big data." The disruptive nature of these fields will continue to challenge the U.S. military across all domains well into the future. To assist with mitigating these risks, the U.S. Army will strengthen its ties with regional allies and partners to maintain the international order, protect access to the global commons, and preserve regional stability.

Russia is also seeking to undermine European and Middle Eastern security and economic structures through conflicts below-the-threshold of war. Russia is using information operations and commercial technology to weaken democratic processes across the western world. Russia's military modernization efforts, expanding nuclear arsenal, and increased operations in the Middle East typify its high disruption approach to reshaping the international order. To help alleviate these risks, the Army will maintain its forward presence in Europe and the Middle East and continue to build interoperability with allies and partners to demonstrate its commitment to countering Russian aggression.

Rogue regimes such as North Korea and Iran continue to pursue destabilizing tactics and technologies to ensure regime survival and increase their own power. North Korea continues to pursue ballistic missiles, weapons of mass destruction, and cyber weapons to threaten the United States Homeland. Iran is using both conventional missiles and state-sponsored terrorism to destabilize the Middle East and increase its regional influence. Forward presence and strong partnerships are important components of the U.S. Army's ability to deter and counter these threats. As part of the Joint Force, the Army will be prepared to respond to either aggression or weapons proliferation by these rogue regimes.

Commercially accessible rapid technological advancements provide terrorists and other non-state actors with more sophisticated tools with which to advance their political, criminal, or other disruptive objectives. The rapid proliferation of low-cost new technologies increases the capabilities of these malicious actors. The U.S. Army will work as part of multinational, interagency, and public-private coalitions to detect and counter these threats. We will seek out capable partners and support their efforts to address the underlying structural, economic, and security challenges that

allow these threats to persist. While the mitigation actions described above are necessary to address present and future threats, they are only part of the solution. In this era of increased complexity, lethality, and competition the U.S. Army will carefully assess the threats we face and make prudent investments in readiness and modernization to meet our national security responsibilities.

THE URGENCY OF MODERNIZATION

For the past several years, the Army has been focused on the near-term demands of the protracted campaigns in Afghanistan and Iraq, supporting our allies in Europe and Asia, and protecting the homeland. The necessary emphasis on these missions, combined with constrained resources, slowed, deferred, and in some cases, halted the development of new platforms and capabilities. Additionally, because these operations required shifts in Army capabilities to meet rotational demands and because U.S. Forces were not contested in the air or maritime domains, the Army reduced or eliminated several capabilities that are vital to large scale combat operations against highly capable adversaries. Our potential adversaries have not been so constrained. Analysis of potential peer competitors' emerging concepts, doctrines, and capabilities strongly suggests they are concentrating efforts between now and 2035 to develop and implement modernized capabilities and hybrid strategies to deny U.S. Forces' ability to project military power and conduct integrated Joint Force operations. Additional efforts emphasize the development of conventional forces with advanced armored vehicles—some of them robotic or autonomous—using extended range munitions, protected by Active Protection Systems, supported by electronic warfare and fires capabilities, and maneuvering into the close fight protected by an Integrated Air Defense (IAD) umbrella. Potential peer competitors have demonstrated they can and will operate with and through proxies and surrogates, artfully employing all elements of national power to achieve their strategic objectives. In this environment, adversary operational systems can exploit existing U.S. weaknesses, such as force deployment responsiveness due to time and distance and vulnerabilities in the homeland and partner nations such as fixed bases, ports, and domestic population. If the Army does not modernize its force to build greater capacity and capabilities to expand and maintain overmatch, we face a future where our formations are out-matched in high-end conventional combat.

The Army's last broad-based modernization occurred in the 1980s. The character of war has changed, and the Army must adapt and innovate faster. Past ways of thinking, organizing, and executing have limited our ability to keep pace with technological development and our potential adversaries. The speed of change in warfighting concepts, threats, and technology is outpacing current Army modernization. Potential adversaries and the industries that support them are integrating technology and capabilities at a much faster rate. The Army is engaged in a protracted struggle to out-innovate our future competitors, and right now, we are not postured for success. Unless action is taken soon, there is the distinct possibility that future adversaries will constrain our Nation's options to deter and defeat them. Without support for increased and stable modernization funding, such actions portend a future with the prospect of increased military risk—that of the inability to deter conflict, losing a war, failing to advance or defend national interests, and suffering an unacceptable toll in casualties.

MODERNIZING THE FORCE

The Army Modernization Strategy has one focus: make soldiers and units more lethal so they can fight and win our Nation's war. It is established upon a vision for the Future Army and the challenges present in balancing near-, mid-, and far-term investments. This singular strategy identifies the ends needed for the Army to accomplish its future mission, organizes the ways, and aligns the means using the resources and activities of the Army's science and technology, capabilities development, and acquisitions enterprise to mitigate tactical, operational, and strategic risk across all time horizons. To provide a comprehensive plan for modernization, the Army establishes and aligns modernization objectives and organizations to orient on potential military peers for the current, next, and future fights that span across and beyond the Future Years Defense Program. All of this must be done within a 21st Century system that provides for unity of effort in support of the modernization process and allied interoperability from the outset.

As our draft strategy lays out, first and foremost, we must return to mastering the fundamentals of shoot, move, communicate, protect, and sustain better than any potential adversary. In the near-term, the Army will invest in capabilities that address critical gaps and improve lethality to expand and maintain overmatch against peer competitors. In the mid-term, the Army will develop, procure, and field next

generation capabilities to fight and win in Multi-Domain Battle. In the far-term, we will build an Army for a fundamentally different conflict environment—one that will require us to exercise mission command across dispersed and decentralized formations, leverage disruptive technologies at the small unit level, and operate with and against autonomous and artificial intelligence systems, all at an accelerated speed of war.

To accomplish these objectives, this year we plan to selectively upgrade the equipment we have and focus our Science and Technology and Research, Development, Test and Evaluation funding on the six Army Modernization Priorities. The six prioritized capability areas naturally align with the Army fundamentals of shoot, move, communicate, protect, and sustain.

- Our first modernization priority is to restore the Army’s Long Range Precision Fires capabilities in order to regain our dominance in range, lethality, and target acquisition. We must provide Combatant and Joint Commanders surface to surface firepower that is precise, responsive, effective and adaptable. It is essential that fire support protects and ensures freedom of maneuver to forces in contact with the enemy in deep, close, and rear operations.
- Our second modernization priority is Next Generation Combat Vehicles. A next generation vehicle is needed to enhance soldier protection, increase mobility, and make our forces more lethal to our enemies. These vehicles must adapt with technology and operate manned or unmanned. The Army’s current fleet of tanks and infantry fighting vehicles are nearing the end of their ability to integrate additional advanced technologies that enable either near-term overmatch or future dominance.
- Our third modernization priority is Future Vertical Lift (FVL) platforms—reconnaissance, attack, assault—that are survivable on the modern and future battlefield. Current aircraft designs have reached the limits for significant incremental improvements. The FVL is an Army-led, multi-service initiative, focused on restoring vertical lift dominance with next generation reach, protection, lethality, agility, and mission flexibility. Systems should also benefit from improved power generation, autonomy, artificial intelligence, and manned-unmanned teaming.
- Our fourth modernization priority is to modernize the Army Network. We must have a communications system that is intuitive, mobile, expeditionary, and can be used to fight cohesively in contested cyber and electromagnetic environments. The Army Network should incorporate electronic warfare; resilient, secure, and interoperable hardware; software and information systems; assured position, navigation, and timing; and low signature networks.
- Our fifth priority is to modernize and restore our Air and Missile Defense systems to ensure our future combat formations are protected from modern and advanced air and missile delivered fires—including drones. The most critical gap remaining after currently planned systems are fielded is that maneuver formations lack air and missile defense. We are focusing on capabilities that include Mobile Short-Range Air Defense, directed energy, and advanced energetics.
- Finally, we must aggressively enhance soldier lethality, a holistic series of capabilities that span all fundamentals including shooting, moving, communicating, protecting, and sustaining. The Army’s foundational capability is soldier and team performance. Unlike other services, the Army fits machines to soldiers rather than the other way around. In this area, we will field not only next generation individual and squad combat weapons, but also improved body armor, sensors, radios, and load-bearing exoskeletons.

To implement this strategy, the Army is currently undertaking a series of acquisition reform efforts designed to promote unity of effort, unity of command, efficiency, cost effectiveness, and leader accountability. Part of this effort is the establishment of a three-star-level task force responsible for mapping out options to consolidate the modernization process under one command. To develop and deliver better solutions faster, the early integration of concept and testing will allow the Army to fail early and cheaply as we experiment, prototype and test, thus increasing the probability of success by learning from early failures. Critical to this effort is the establishment of Cross-Functional Teams (CFTs) for each of the identified modernization priorities. Each CFT will incorporate elements from acquisition, testing, resourcing, and capability development communities and directly report to Army senior leaders.

THE DEFENSE INDUSTRIAL BASE

The past trends of constrained resources in the Army's modernization account have led to significant challenges for the Defense Industrial Base (DIB), especially for companies that cannot leverage commercial sales and for small companies that must diversify quickly to remain viable. When developing our equipment modernization strategy, we have carefully assessed risk across all portfolios to ensure balanced development of new capabilities, incremental upgrades to existing systems, and protection of critical capabilities in the commercial and organic elements of the DIB.

The Army remains concerned about the preservation of key skills and capabilities in the engineering and manufacturing bases for our original equipment manufacturers and their key supplier bases. Collaboration with our industrial base partners early in the process helps reduce risk. Efforts such as the Army Manufacturing Technology Program has provided affordable and timely manufacturing solutions that assist our industry partners to address manufacturing and producibility risks. Also, the Army supports efforts to develop Foreign Military Sales (FMS) and Direct Commercial Sales to ensure sustainment of critical production lines in the DIB.

The Army continually assesses risk in the Industrial Base across all Army portfolios. Fragility and Criticality (FaC) assessments identify the fragile and critical portions of sectors within the DIB to facilitate the identification of risk mitigation strategies. The FaC assessments provide Army program offices: 1) the information to identify how funding adjustments could affect suppliers that provide the products, skills, and services needed to maintain readiness, and 2) information to support investment decisions to mitigate supplier risk.

The Army also continually assesses the health of the organic industrial base (OIB), including our depots, arsenals, ammunition plants, munitions centers, and Government-owned Contractor-operated plants. The Army maintains critical skill sets in our OIB by identifying workload to preserve capabilities, exploring FMS opportunities, and encouraging our OIB facilities to partner with commercial firms and other Department of Defense organizations, such as the Defense Logistics Agency, to meet future requirements. We continue to modernize our OIB infrastructure, as needed, to support readiness.

IN CONCLUSION

We sincerely appreciate the opportunity to address the challenges the Army faces in maintaining readiness and modernizing its force. We are grateful for Congress's efforts to increase Army Force structure. The Army will apply the increased end-strength authorized by the last two National Defense Authorization Acts to ready combat formations to deter our adversaries, and if called upon, decisively win our Nation's wars. Additionally, we believe that the President's commitment to restoring the military will be clearly evident in the Fiscal Year 2019 Budget Request, especially in Army modernization. We believe it will be a good start towards reversing the historical and significant shortfalls in modernization funding, but one year will not, by itself, reverse the trend. We must have predictable and adequate funding across the Future Years Defense Program and beyond.

We can assure you that the Army's senior leaders are intently working to address current challenges and the needs of the Army both now and in the future. We are doing so with a commitment to be good stewards of our Nation's resources while meeting the readiness, equipping, and modernization needs of our soldiers.

Mr. Chairman and distinguished Members of this Subcommittee, we sincerely appreciate your steadfast and strong support of the outstanding men and women in uniform, our Army civilians, and their families.

Senator COTTON. Thank you, General Dyess, and thank you for your many years of service to our country. Since you have concluded, I will keep you first in the shoot here. Let us start with the threats that we face so we can talk then about the strategy we need to counteract those and the modernization approach to implement that strategy.

The National Defense Strategy and the National Security Strategy directs the Department of Defense to prioritize threats from Russia and from China. In the past in testimony to this subcommittee and the full committee, Army leadership has emphasized the rapid pace of modernization that those two countries have undertaken while the United States has been fighting low-intensity

counterinsurgency wars in Iraq and Afghanistan. In light of this direction, in light of these circumstances, what is the Army's mission-critical focus in your opinion?

Major General DYESS. The threats have been documented well in testimony both by previous leaders but as well as we talked about that last year. As far as the multi-domain battle concept in the 21st Century warfare battlefield that we see, it has expanded in several ways to include geography. We think that we will be attacked in the homeland if not by cyber but by other means that we will have to, because our forces are mostly stationed in the United States, deploy to areas in which we will conduct those operations, that us in the Marine Corps see that the close fight is certainly common considerations for both of us, the Air Force establishing joint bases and establishing air dominance in an integrated air and missile defense capability A2/AD [Anti Access/Area Denial] environment.

We are going to be contested on all domains. It is going to be increasingly lethal on the future battlefield, that it is going to be increasingly complex with urban cities and dense urban terrain and that our deterrence is going to be challenged. Quite frankly, we want to make sure that deterrence is forefront in our problem statements so that we do not have to fight a war and an armed conflict.

Senator COTTON. Thank you. General Anderson, the vice chairman, General Selva, in recent media interviews recently elaborated on the National Security and National Defense Strategy looking at the threat of China and Russia, explaining that China would be predominantly a maritime and air operation, whereas a threat from Russia most likely in the European theater would be primarily an air and ground operation. Can you elaborate on what that means for the Army's future modernization plans?

Lieutenant General ANDERSON. Yes, sir. Anti-access/aerial denial is going to be a factor for air and naval forces, again, which is all the things that I was talking about in the multi-domain concept about how we enable naval air forces to get into a China scenario. I think what you both mentioned in your opening comments, all things long-range fires, all things ballistic missile defense, all things armor are huge capability gaps. I think to fight the China challenges that are posed in the NDS, which are the threats against Taiwan, South China Sea, the Russia threats against NATO [North Atlantic Treaty Organization], both of their aspirations from a nuclear scenario, and then you throw in the North Korean nuclear scenario, you throw in the terrorism and the counter-WMD [Weapons of Mass Destruction] scenario, and then you throw in the information environment, and I think that reinforces all of our efforts in the multi-domain fight and how you do offset and how do you potentially achieve the ability of an army capability to sink a ship at sea, you know, from afar?

I think as we work those capabilities, that will very much play out in a China scenario, and I think everything we have talked about fits into the Russian piece about countering armored formations coming across Eastern Europe.

Senator COTTON. When was the last time American soldiers fought against an enemy who had sustained aerial attacks against U.S. soldiers?

Lieutenant General ANDERSON. Never.

Senator COTTON. What is the state of our air defense artillery?

Lieutenant General ANDERSON. We have got a long way to, so that was one of the billpayers of sequestration. We took air defense capability out of our formations, so you are seeing the efforts here to put mobile SHORAD [Short-Range Air Defense] back into two per a division formation. We are shooting to get two battalions established by fiscal year 2021, but you are seeing our 72 Avenger upgrades that we are doing right now to get into Europe. That was all part of the heavy focus on Europe 2 years ago, and now, we are fast-forwarding that obviously to the Pacific.

But, you know, we are doing everything from getting mobile shoulder-fired Stingers out of all of the warehouses to enable crews and teams to be deployed in each of these theaters, so at least you have got something within your organic capability, you know, and then obviously we have got THAAD [Terminal High Altitude Area Defense], Patriot, and those systems that are all being enhanced for missiles, radars, sensors, and all the things that are going on in those arenas. But right now, the basic problem is combat formations do not have capability.

Senator COTTON. Thank you. My time has expired. I will turn now to Senator King.

Senator King. Thank you, Mr. Chairman.

I am looking for an update. We have talked a lot over the past year in the Army, as I mentioned in my statement, I commend you for the focus on these issues of modernization and setting up functional teams, the Futures Command. Tell me where we stand. When are we going to see results?

Lieutenant General MURRAY. Senator, as you know, the Army stood up a plans team or an analysis team under the leadership of Lieutenant General Ed Cardon to work through the mission analysis for the Chief and the Secretary. None of us are a part of that small group. It has been a fairly small self-contained unit that is going through analysis. They just recently completed a tabletop exercise. I believe they war-gamed about six courses of action. As far as I know, they are still on track to come back to the Secretary and the Chief with a recommendation on exactly what this organization will do, what it will consist of.

Senator King. You are talking about the Futures Command?

Lieutenant General MURRAY. I am, sir. I believe the last date I heard was March, and as far as I know, they are still on track to come back to the Chief and Secretary with laying out those decisions for them.

Senator King. A possible set up by summer?

Lieutenant General MURRAY. Last I heard, IOC [Initial Operational Capability] or initial operation capability June, July of this year with a full operational capability to follow about a year later.

Senator King. Here is the real question: Do you think we are really going to be able to break down the stovepipes?

Lieutenant General MURRAY. Sir, I do. I think the biggest challenge for this organization is doing exactly that, and it is culture

more than anything else. So I think the biggest challenge for this organization would be to reshape the culture to get after those stovepipes. It is just not the acquisition process. It is the requirements process, it is the material delivery process. It is the testing process. It is the bureaucracy associated with it. That is exactly the intent of the Chief is to stand up this organization for unity of command and have a single commander focused on doing just what you suggest, is getting after acquisition, big A acquisition from requirements to delivery of capability to our soldiers in a very rapid fashion, somebody focused on that each and every day, which right now it is spread amongst many organizations.

Senator King. General Ostrowski, just a specific question. You had some time on protests. What percentage of significant acquisition contracts are protested?

Lieutenant General OSTROWSKI. Sir, I will tell you that I do not have that exact number of ones that are protested. I will tell you this, that 92 percent of the time the army on average wins those protests. So we lose about 8 percent over time. The other services have a record that is even better than that. However, I have numerous programs now that are in protest, Lakota being one of them, as you know. That is one that is out there. There are numerous other ones that are—

Senator King. Do I understand that the production, the progress on the contract is stayed pending the protest?

Lieutenant General OSTROWSKI. Yes, sir. When you protest to the GAO, the GAO has the ability to immediately execute a stay unless it is beyond the time that you are allowed to protest in the protest window. So in all cases for the GAO, unlike the Court of Federal Claims, it is an automatic stay. The Court of Federal Claims holds a stay hearing to determine whether or not to put a stay on the particular case or to not, and then go through the process of adjudicating.

Senator King. But still, that is more time, more bureaucracy, more reports, more studies.

Lieutenant General OSTROWSKI. That is correct. In fact, what happens is our contractor is not allowed to move forward. The program office sits idle, and so does the contractor.

Senator King. You went through very rapidly a whole series of recommendations for us. I am sure that is in your written testimony, but if you could supply those in a succinct form with some explanation as to where you think we can help with this process because we are going to be working on the National Defense Authorization Act starting in a few months, and it would be very helpful to have those specific recommendations. Let me change the subject for a minute. Talk to me about utilization of off-the-shelf products or designs. I hope that is a sort of place to start rather than designing something entirely new to our requirements.

Lieutenant General OSTROWSKI. Yes, as we go through the process, the first thing we should do as a community is determine whether or not our tactics, techniques, and procedures can change in order to address the threat. If they cannot and a material solution is the first thing that we have to go to, the first thing is to go off and ask if we can find a commercial product capable of doing what it is that we are trying to do in terms of filling in the gap.

If we cannot find that, then the next step is to go to our allies to determine whether or not there is a capability that exists in a foreign country that is capable of doing so. If the answer is still no, the final step is then to develop. Unfortunately, too often, we jump right to the development instead.

Senator King. That is what concerns me. I mean, that is the history.

Lieutenant General OSTROWSKI. That is correct, sir, so we are in the process of changing that. Again, it allows us to get capability to the force faster, the only drawback being it is not leap ahead. That would be the only drawback. But it allows us to get the capability to our forces in a faster manner, knowing that everybody in the Army does not need to have one.

Senator King. I am just about out of time, but I think the comments that you have made, we are talking about a deep cultural change in the way a system has been operating for years and years and years. Cultures are the hardest thing to change. General Murray, do you think that is happening? Is the word out there? Is there a sense of urgency about this?

Lieutenant General MURRAY. I think it is, sir. I think we have made a great start. The Army is a big organization. As the saying goes, it takes a long time to turn a big ship. I know General Ostrowski and I co-chair a lot of meetings where this type of dialogue comes up, and it is a consistent message from both of us. I just thing, I mean, you have got to establish the culture change and then continue to drive it year after year in some cases to make sure it resonates throughout the organization. But I do not think it is going to be a quick culture change because cultures do not normally change quickly, but I think with constant reinforcement and with the reinforcement we are getting from most senior leadership, I think it will happen over time.

Senator King. I found it salutary to remind people and organizations that I work for that it took Eisenhower only 11 months to retake Europe. It sort of gives you a time frame for getting these things done. Thank you, Mr. Chairman.

Senator COTTON. Colonel Sullivan.

Senator Sullivan. Thank you, Mr. Chairman. Gentlemen, thank you for your service and being here today. General Dyess, congratulations on your upcoming retirement. I am sure you will miss the Army but probably not miss hearings like this.

[Laughter.]

Senator Sullivan. General Anderson, I want to thank you. I had the opportunity to go see the 4/25 over the holidays out in Afghanistan, and morale was high and the troops are doing well, so thanks for all your and other Members and General Milley's recognition of the importance of that unit.

I wanted to talk first just kind of on an operational issue. The European Reassurance Initiative, which has been a very kind of heavy Army-led initiative, what impacts are we seeing on our deployments there in terms of our allies, maybe Russian reactions? Are we seeing it in a positive way, and can you give us some anecdotes on that?

Lieutenant General ANDERSON. Sure, sir. Good to see you, as always.

The requirement of going to a heel-to-toe armored brigade combat team rotation has required us to take a brigade that we had dedicated to testing at Fort Bliss and put that into the rotational pool so we could sustain, you know, three to Korea, three to Kuwait, three to Europe on top of the two assigned brigades, there the 173rd and the 2CR. So the strain there in terms of maintaining that, having a small hundred-man division cell that was the fourth division getting ready to be the first division is the command and control element underneath Army Europe has been an additional requirement, and then the enhanced forward presence package, which is the Baltics. That is the Latvia, Lithuania, Estonia piece, which Canada, Germany, and the U.K. and us in Poland and maintaining that rotational battle group with an infantry company from the U.K. and a SHORAD company from Romania. That commitment, sir, has again been—that was something we did not plan on doing 2 years ago, so it is an additional strain on the force.

The problem with the European activities operation Atlantic Resolve, it is not a named operation, so that means commanders cannot stop-loss, stop-move people. There is no entitlement pays. You actually lose your separation pay. It is not a tax-exempt deployment, so when people compare that to other deployments from a family/personal situation, people do not like that because—

Senator Sullivan. Are the things that we can do to help with regard to addressing that because it certainly seems to me, you know, in the category in importance of any other type of deployment?

Lieutenant General ANDERSON. It is really an internal Department of Defense thing in terms of authorizing it to be a named operation or not, you know? Then the issue for Europe, sir, is—

Senator Sullivan. Why has it not been—

Lieutenant General ANDERSON. Because a lot of people think they have enough resources to get the job done, but when you go visit them and you watch that brigade commander being challenged to maintain his manning levels because he is not allowed to keep people if they are scheduled to ETS [Expiration of Term of Service], retire, whatever. He can take them, but when they are 2 months out from having to leave the Army, he has to send them home. So that is a constant rotating door—we are on our second turn right now—and we struggle to keep that brigade at 80 percent strength while it is in Europe doing, you know, the exercise program.

Senator Sullivan. Yes. Let me kind of ask a somewhat related question. General Dyess, during the March 2017 all arms warfare hearing it was discussed that there is a lack of advanced airland battle and training exercises. I know General Milley has been talking about much bigger training exercises as a way to integrate the entire force with combined arms. I know a lot of that is done out at NTC [National Training Center]. There is an NDAA provision that takes a look at that. I just want to highlight for you the—and I am sure most of you are familiar with it—but the Joint Pacific Range Complex in Alaska, has a land space the size of Delaware, airspace for fifth-generation aircraft the size of Florida and naval sea space the size of Virginia. So are you looking at that as you are looking at major, you know, kind of division-type exercises

where you could exercise a couple brigade or even a division and have airspace that is more realistic with the fifth-generation type standoff?

Major General DYESS. So, I will start off and then I will pass it to General Anderson because I will talk about experimentation. We do experimentation inside of TRADOC [Training and Doctrine Command], and so what we want to do is make sure that we are interoperable with our allies, and all the combined arms but also to be able to have secure voice digital fires and a common operating picture. We do need the space to do that. We are conducting the——

Senator Sullivan. Does NTC provide you the space or——

Major General DYESS. No, we are actually doing the next one in May in Germany with the U.K., the French, the Germans, et cetera. White Sands, Bliss is where we do a lot of those as well where we own all of airspace as well as the electromagnetic spectrum.

So on the experiment side we would like to have the ability to have our coalition partners and our joint partners together to determine where we can make strides in interoperability. I will pass it over to General Anderson on the training side because there is also a training activity that occurs like the 18-4 activity with the U.K. division with our XVIII Corps.

Lieutenant General ANDERSON. Yes, the key, sir, since we took away that dedicated test unit between home station training, CTC [Combat Training Center], the combat training centers, and exercises, we have to leverage how we test stuff because we no longer have a dedicated time and space or unit to do it. But what Bo is talking about, our allies want to play in their backyards, and we have to have a draw to them. He just described what we are getting ready to do here this spring. All of them want a—a large number of NATO members want to play in this exercise because it is in Europe and it is all things Russian.

You asked again what is a deterrence versus assurance? Well, it is obviously assuring them but that the Russian deterrence, when you can mask multiple countries with multiple capabilities in and around Europe, that sends a pretty loud and clear message, and that is why we have to leverage that kind of stuff versus coming back in the States. We are using—even more so than Polk, Irwin, you know, Nellis, and those kind of places. That is the key. That is what they want.

Senator Sullivan. Thank you.

Senator COTTON. Senator Peters.

Senator PETERS. Thank you, Mr. Chairman, and gentlemen, thank you again for being here today.

I want to pick up on the acquisition and the need for a much quicker process that has already been raised, and all four of you raised in your testimony as well. I am going to give you an assessment that someone gave me about looking at the different acquisition communities and just kind of get your sense how accurate you think this is. You basically said that basically we have got silos and you have got the science and tech folks that probably need to do a whole better job of reaching out to private industry and some of

the new cutting-edge technologies and try to examine what the possibilities are. There is not enough of that that goes on.

The testing community sets unrealistic goals, and so there is a lot of failures because the goals are unrealistic and so the programs die or do not move forward. The requirement community always wants to do too much and be all things to all people, and that is also impossible as well. So you start putting all of that together in the hopper and everything kind of grinds to a halt, which is obviously unacceptable at a time when technology is advancing at a pace we have not seen in human history. How would you characterize that assessment? Are those legitimate concerns that we need to be thinking about with those kind of communities? Whoever?

Lieutenant General MURRAY. I will take it, sir—

Senator PETERS. Yes.

General MURRAY.—if that is okay. I will start off and I will turn it over to General Ostrowski and I will try to stay with the requirements piece of it you talked about and let him talk the true acquisition piece of it.

So I would say that you are fairly accurate, whoever you have talked to. We do a poor job of reaching out to industry. A lot of times that is because of concerns by our lawyers that—in terms of competition and unfair advantage to different competitors. I think we are getting better at that. That is one of the roles as a CFT [Cross-Functional Team] and our senior leadership. The Secretary and the under and the vice have sat down with numerous industry leaders over the last 2 months or so to figure out what is going on in industry. Getting our science and technology folks to reach out to industry is important, as well as our engineers to see what is available.

Somebody mentioned earlier about fielding stuff quickly. We are interested in fielding stuff quickly using technology that exists today, but it has to be able to be upgraded over time. You know, we have been criticized, rightfully so, for our modernization efforts in the past, but we have been fairly successful in incrementally upgrading the equipment we have. The M1 of today is vastly better than the M1 we fielded back in the mid-1980s.

Senator PETERS. Right.

Lieutenant General MURRAY. So when you acquire something quickly, you also have to make sure that you can upgrade it over time to account for new technologies. Part of that is software-defined systems. Part of that is the size, weight, and power to accommodate new systems in the future. That is a piece of it. I think we have a very risk-adverse culture. I mean, I do think our requirements are over-specific. I think our testing community—the Army's testing community has made great strides. We now have as part of the CFT for the programs they are working on testers, engineers, S&T [Science & Technology] experts, and hopefully soon industry sitting down with the requirements writers. So before we write a requirement, we know it is feasible, it can be tested relatively cheaply and in a fast amount of time, and that industry can actually produce it. That is kind of what we are after as we go forward.

Lieutenant General OSTROWSKI. Sir, I would just add that General Murray hit it on the head, and you did as well. The key to the

CFT standup, the impetus behind the CFT standup was to address the very issue that you brought up. Now, the key is to get that culture ingrained in the rest of the Army. We know that there are only six of these. The intent is for that to trickle down, have a trickle-down effect throughout the entire army so that our program managers, our testers, our engineers, our scientists, our contracting officers, and industry are engaged in a process of determining what is in the realm of the feasible so that when right requirements, we get after the capabilities that we need in the time frame that we need them and the capabilities that exist today in terms of technology.

Lieutenant General MURRAY. I would like to add one more thing because it is critically important is early soldier involvement and often have soldiers involved in the process so soldiers are part of the development of the requirements and soldiers are part of the process all along to make sure we deliver the capability they expect at the end of the process.

Senator PETERS. Actually, I would like to pick up on that, General, because that is the other aspect of fighting the war of the future that all four of you have mentioned. It is not just the equipment; it is also the doctrine and the operating doctrine. History is full of examples where armies with inferior equipment still beat the others because they could operate—they had a doctrine that allowed them to operate much more effectively, so that has got to be a key part of how we integrate with these new technologies that are changing rapidly and will require human machine interfaces in ways that we have not seen before.

But I guess I am running out of time here. My question is, in your view, should technology drive doctrine or should doctrine drive technology?

Major General DYESS. I will take that one. Doctrine is actually things that we can do today. Concepts are the things that drive us toward the future. So we have taken and redone FM 3-0—that is our operations manual—but considering the things that are in the multi-domain battle that we can do today. So from my perspective we take a look at the future and the technology as it is changing and then incorporate that into the doctrine. That is my perspective on that.

Lieutenant General MURRAY. I would just say it is not a chicken or egg. They will feed off of each other.

Senator PETERS. Right.

Lieutenant General MURRAY. There will be technologies that will drive new concepts and there will be new concepts that will drive us to develop new pieces of hardware.

Senator PETERS. So you have to be flexible in both ways?

Lieutenant General MURRAY. Absolutely, sir.

Senator PETERS. Great. Thank you.

Senator COTTON. Senator Wicker.

Senator WICKER. Gentlemen, thank you very much for your service, and thank you for working hard during a trying few years that you have had to deal with because of decisions made in this building and on this Capitol Hill.

On page 2 of your statement you say, “The Army has reached an inflection point: We can no longer afford to choose between improv-

ing our existing systems and developing new ones. We must do both.” I was asking in another setting the Secretary of Defense about his statement that we have been climbing out of the readiness hole, and we are going to have to do both now, readiness and modernization. Your statement was prepared before we got the news today about the agreement between the White House and Republican and Democratic leaders in the Senate about the new defense caps. If we do not pass the new defense caps tomorrow, what does that do to your ability to make this sentence come true?

Lieutenant General MURRAY. I think it would be devastating, Senator. As you mentioned, that prepared statement has been done for probably about a week-and-a-half now, and that specific sentence was crafted with the 2019 President’s budget request in mind. So if we do not get a budget, if we go to a sequester, we go to some kind of furlough again, we would not be able to do both.

Senator WICKER. Actually, what I think we are going to do if we have got the votes is we are going to appropriate to the National Defense Authorization Act level. I think the House of Representatives has demonstrated that they already have the votes to do that. What have we not been able to do? Help the people who are listening by way of C-SPAN right now. Help us to understand what is at stake in terms of actually what we have not been able to do and what we have been able to do, if we take a grownup vote tomorrow and actually give you what you need?

Lieutenant General MURRAY. Just a couple of examples, Senator. So the only new developmental program that we have started in the 2 years that you have mentioned is the Mobile Protected Firepower light tank. We have no other new developmental combat vehicles in production, and that is not even in production. We are expecting some bid samples here in the next month or so to go into a downselect for a producer. We have been focused solely on keeping the equipment we have as modern as we possibly could while others have modernized their fleets.

We have no new aircraft in production. We are still flying the same aircraft that we were flying in the 1980s that came out. Probably the worst part of that is with the resources we have been operating with, with the focus on readiness was exactly where the focus should be, we would be using the same fleets for the next 20 or 30 years. This budget request I firmly believe—and if the numbers are anywhere near the NDAA level, we will be able to start development of new systems that we will need on the future battlefield. So we have been maintaining parity as best we could by incremental upgrades to systems, but there is nothing leap ahead about what we are doing. That is what we want to do is go after the system that will provide us the overmatch into the future against a peer adversary.

Senator WICKER. Okay. Let me shift gears in the last minute. As you know, Army Corps of Engineers ERDC is located in Vicksburg, Mississippi, high use of supercomputing there. To what extent is supercomputing important Army-wide in getting you the information you need and how weapons systems respond to complex environments? Who would like to take that?

Lieutenant General OSTROWSKI. Sir, I can take that. It is absolutely critical. Frankly, with respect to the Chinook helicopter, our

Block 2 Chinook, we have avoided about \$50 million worth of costs in terms of flight based on being able to supercompute the effects that the new blade rotors are going to have on the aircraft, the new fuselage is going to have on the aircraft. We can avoid all that through the stimulation of training that the supercomputers divide us.

With respect to the tank, Abrams tank in terms of its armor, the ability to—as we upgraded the armor in the last version, the B3 version of the Abrams, the ability to use the supercomputers to determine what the armor would be capable of doing in terms of the threat, you know, whether it be kinetic or whether it be RPG [Rocket Propelled Grenades] or whether it be in ATGM, what would be the result of the armor that we add as a result of being able to stop those particular threats, all made possible by the supercomputing capabilities that you mentioned? It is critical to us. It is critical to the joint force. The Army is just one participant in this. We have the other services as well, and so it is a great capability, sir.

Senator WICKER. Thank you. Thank you, Mr. Chair.

Senator COTTON. Senator Warren.

Senator WARREN. Thank you, Mr. Chairman, and thank you to all of our witnesses for being here today.

You know, we have been concerned in recent years that near-peer competitors like China and Russia are narrowing the technology gap and putting our forces at greater risk if they ever had to engage in conflict. So in response, the Army has announced plans to establish new futures and modernization command focused on your six modernization goals, things like next-generation ground vehicles and more survivable helicopters and more resilient networks.

I understand that in each of these priority areas you plan to integrate the requirements development and acquisition processes into combined teams focused on your modernization goals, and I think this is smart. I think it is a good thing that you are planning to do. But today, much of the cutting-edge technology is not developed within the Pentagon but over in the commercial sector or in the laboratories, at our colleges and our universities, so I want to ask about a different kind of integration between the Army and these outside innovators.

I thought I might start with you, General Ostrowski or General Dyess. How important is it to capitalize on commercial and academic developments in advanced technology? As the Army develops this command, what steps are you taking to make sure that you are closely tied to these outside innovators?

Lieutenant General OSTROWSKI. Ma'am, I will start, and then I will turn it over to Bo, but the bottom line is that it is absolutely critical that our communities within our organic S&T work with industry across the board. We have numerous programs that initiate that piece.

One of the things that the Hill has given us in terms of capabilities is this thing called other transactional authority. As you know, ma'am, 90 percent of the businesses in the United States do not want to do business with the Department of Defense because it is too bureaucratic, it is too hard, especially small business and inno-

vative companies. The use of other transactional authorities allows us to get around those FAR [Federal Acquisition Regulation]-based contracting. It allows us to work with these small units and small businesses and so forth. So it has been a critical step to that.

The establishment of the DIUx, again, at the Department of Defense level, able to reach out to these industries that would not be willing to normally do business with us, again, breaking those barriers down. So there has been numerous efforts to try to get at that 90 percent of the population in terms of our companies that want to do business with us to be able to do that.

Senator WARREN. Good. So breaking down the barriers, DIUx, you sing my song when you talk about them. General Dyess, what would you like to add?

Major General DYESS. Just that we need to know what technology is out there on the Department of Defense side when we write requirements and so that we do not write a requirement that is not attainable.

Senator WARREN. So how do you do that?

How do you find out?

Major General DYESS. So it is back and forth. It is exchange of information. It is here is the way we would like to have the requirement. Usually we are not at the technology readiness level that you desire, and then there is trades discussion that happens with all of us on this table here, General Murray on the resource side, General Ostrowski on the acquisition side, and me on the requirements side. So there is trades discussion that happens inside of that. It has got to be informed by the technology that is available out there in those small companies—

That is key—

Senator WARREN. That takes some systemic interweaving as you go along. You know, I may be biased, I probably am, but I think Massachusetts is the most dynamic innovation economy linking world-class universities, federal labs, commercial startups—

Senator KING. We call it southern Maine.

Senator WARREN. Yes.

[Laughter.]

Senator WARREN. Social climber.

[Laughter.]

Senator WARREN. And that we have workforce that has the best STEM [Science, Technology, Engineering and Mathematics] education in the country. When I go home to the Commonwealth, there are a lot of people there who ask what can I do to serve my country? What can I do to be part of the defense of this nation? So I just want to make sure that this question about innovation as you are thinking about how better to integrate going forward is not only about the Army and what gets developed within the Pentagon but what we are developing out there in the rest of the world. They are opening up new horizons every single day, and it would be very much to our detriment if the Army missed that. So I hope we can continue to work together on that.

Thank you all for being here. Thank you.

Senator COTTON. I will begin round two.

General Dyess, I want to ask two more big-picture questions and would appreciate the answer in the simplest most layman's terms.

What is the Army's modernization strategy, and who is responsible for that strategy?

Major General DYESS. Well, the Secretary and the Chief are going to approve the strategy, and they are going to submit that strategy in accordance with the NDAA by the 30th of April of this year. The strategy essentially lines up the modernization priorities that have already been, as you have talked about, Senator King and my colleagues here at the table, essentially tells you how we intend to get after those modernization priorities.

There is an upfront piece that establishes the current state that we find ourselves in on modernization, but I would say the majority of the document are in annexes that describes the six modernization priorities, as laid out by the Secretary and the Chief in some detail.

Senator COTTON. If I call Army leadership principles, the Secretary and the Chief are responsible for everything the Army does and fails to do? Is that—

Major General DYESS. Well, title 10, manned, trained, equipped, assessed station is the responsibility—

Senator COTTON. Who beneath the Secretary and the Chief is personally responsible for the Army modernization strategy?

Major General DYESS. Well, there are a lot of people helping them, Senator, but I think I am helping writing that down at Army Capabilities Integration Center with the help of my colleagues here at the table.

Senator COTTON. Thank you. Building on that, what are the key objectives of our modernization strategy in the near term, say, defined as the next 2 years?

Major General DYESS. I think in the next 2 years—and you will see this I think when the PB19 comes over—is a thorough review of our science and technology dollars that are aligned to the modernization priorities. A lot of those modernization priorities, unless we do off-the-shelf of existing equipment that is out there, are going to deliver in at least 2021, 2022, and beyond time frame. So if you ask the question what is happening in the next 2 years, it will be a realignment of some of those dollars, which you will be able to see on the 12th, and then essentially the experimentation and demonstration of capabilities that those cross-functional teams will be doing, and then in the early to mid-2020s the delivery of capability.

Senator COTTON. Thank you. General Ostrowski, sticking with the big picture, the Army future combat system was, let us just say, less than a tremendous success. General Milley acknowledged this in recent remarks to the Association of the U.S. Army, but he also stressed that we do need to have a significant leap ahead in the technology that we are fielding, 10X in fact he said, and pointed out some examples from the 1980s how we succeeded in that effort with systems like the Abrams, the Bradley, Patriot, the Apache, the Black Hawk. How do we model on that success from the 1980s and avoid the failures of the Future Combat System?

Lieutenant General OSTROWSKI. Mr. Chairman, the key is to do the experimental and the prototyping up front and early with soldiers. General Murray mentioned this earlier. If we are going to fail, we need to fail early. So early prototyping is absolutely essen-

tial in getting after this piece. The problem that we have had in the past has been we have been too I would say hurried to rush into a program of record. Once we did, with technology that was never even ready for the technology readiness reduction phase of the program, so we have to spend more time understanding the technology first, writing the requirement to do so, and then once we understand the state of the art of technology, ensure that we prototype that and we fly before we buy before entering into a major effort.

Lieutenant General MURRAY. I would just add, Mr. Chairman, we also have to be comfortable with the 80 percent solution as the initial development. I would just go back to the M1 tank, which you mentioned was originally fielded with 105 millimeter cannon. We knew we needed 120 millimeter. The technology was not there, so we fielded it with 105 with the space to upgrade it to a 120 as we went along, so that type of 80 percent is good enough—perfect is the enemy of good enough—and then get on with it and improve it over time.

Senator COTTON. Thank you. I want to turn to more specific programmatic questions from the big-picture questions I have explored, but first, I will turn to Senator King for his second round of questioning.

Senator KING. General Ostrowski, I have some questions about the industrial base. I am concerned about the loss of smaller firms either because they cannot compete or—we have had testimony before the full committee that smaller firms, particularly in places like Silicon Valley, just will not even bid anymore they are so fed up with the Pentagon process and the burden and how long it is and the restrictions. I am worried about the consolidation of the industrial base and the loss of smaller, agile, creative companies. Talk to me about that. How can we be sure that we are not going to lose the innovation that comes from these smaller companies because of the cumbersome nature of the process? I am sure you understand what I am talking about.

Lieutenant General OSTROWSKI. Senator, I do, and I understand exactly where you are coming from. The bottom line is that, as you know, 90 percent of the companies in the United States do not even want to do business with us because it is too cumbersome, and so the thing—

Senator KING. That is a really bad sign.

Lieutenant General OSTROWSKI. Yes, sir, but the bottom line is that the things that you have been able to allow us to do, the other transactional authorities piece that I mentioned a little bit earlier allows these companies to be able to want to then do business with us because the burdens of the FAR are not placed on them. So that is a huge tool that we have been able to use as we go forward, especially with the smaller companies.

The other piece of this is ensuring that we understand from a big supplier perspective. We need to know the second-, third-, and fourth-tier level suppliers throughout everything that we are doing and being able to work with our primes to ensure that we have a status on each one of those because if any one of those are going to go out of business based on lack of orders or whatever the case

may be, we have to be able to support those companies because they do provide a capability that no one else does.

Senator KING. Right.

Lieutenant General OSTROWSKI. We have programs associated with the Army and the other services to be able to identify those companies and continue to support them because they have those critical components that nobody else will produce.

Senator KING. Let me change the subject from acquisition, which is mostly what we have been talking about, and talk about doctrine and hybrid war. Are we developing the doctrine to deal with an entirely different kind of incursion such as what we saw in Ukraine or Crimea? That is a difficult strategic and doctrinal question because you never really quite have that kinetic, you know, event that can trigger a conventional kind of response. General Dyess, what do you think about that? Is the Army thinking about this?

Major General DYESS. I would be glad to talk about that, Senator, because I think that when we talked about the battlefield framework and the expansion of just not only geography but also time. Instead of the joint planning construct would have the phases, phase 0 through phase 5, we have essentially done away with that because in that construct you are either in armed conflict or not in armed conflict. You are either yes/no, black/white, on/off when in fact, short of armed conflict, we are in competition right now, and that is what we are calling it, a competition phase, an armed conflict phase and then a return-to-competition phase. So there is activity that is occurring—

Senator KING. But I think we need a term between—competition sounds benign. If the Russians interfere in the elections in the Czech Republic and elect a pro-Russian as President, that is not competition. That is something else. It is between competition and conflict, but I think we need to find another concept. I see it as beyond just competition.

Major General DYESS. I would not disagree with you, but that is our first cut on this to try to describe something that is short of armed conflict because if you just have yes/no, black/white, on/off armed conflict, no armed conflict or 2.9—

Senator KING. That will not do today.

Major General DYESS. It is not good enough.

Senator KING. No.

Major General DYESS. That is our first attempt at it. But we have incorporated some of that into our current doctrine and thinking especially in the area of space, cyberspace, electromagnetic spectrum, information operations, cognitive dimension of warfare. We are starting to develop things in those areas that answer that question.

Senator KING. It seems to me that this is an area where we have to really pay close attention to our allies because that is where this is going to happen. It is going to happen in the Baltics or it is going to happen—you know, it is already happening in the Ukraine. It is going to happen in other areas. We have got to have a very close relationship because they are on the ground and see it. That has been my observation. We are going to have to listen to how they expect to deal with it.

Major General DYESS. So our first problem—and we have identified in the multi-domain battle those five problems I talked about. The first one is how do U.S. Forces deter the escalation of violence, defeat adversary operations to destabilize the region, and turn denied space into contested space should violence escalate? That is our first problem. I think it is very important to define the problem before you start chasing down solutions, and we identified that as one of the problems with this new framework in multi-domain battle.

Senator KING. Well, I am concerned that Russia can rebuild the Soviet empire without firing a shot by political manipulation and other kinds of I guess I call it subversion in some of these Eastern European countries. They are proving themselves pretty adept at that.

Thank you, gentlemen. I appreciate it.

Senator COTTON. Gentlemen, as I said, I would like to go through some more programmatic questions now, turning away from the big picture. Senator King, I will invite you to interject at any point where you might have anything to add. I will direct my question to one of the witnesses, but if anyone would like to volunteer for an answer, please feel free to jump in. If the question is directed towards you and you would like to volunteer one of your peers to answer, please do that as well.

General Milley and Deputy Secretary McCarthy addressed a lot of the Army's top modernization priorities last year at the AUSA [Association of the United States Army] convention, so I will take my guidance in part from their remarks, the first among that is long-range precision fires. General Ostrowski, can you tell us where the long-range precision fires program stands today and when do we expect capability to reach the field?

Lieutenant General OSTROWSKI. Yes, sir, I would be happy to. The long-range precision fires is in the technology maturity risk reduction phase. We have two competitors—Raytheon, as well as Lockheed Martin—that will be providing us up to four missiles, for missiles exactly by the fourth quarter of 2019 in order to flight-test those missiles. We will flight-test three of the four. From that point we will be able to determine just how close we are getting to the requirement of the 499 capability in terms of kilometers in the range. Depending on the maturity of what we get, the intent is to move into a milestone B on that program in second quarter of 2021 and move forward from there. Again, it will all depend on where we stand in terms of the technology and how fast we can deliver this capability. Right now, worst-case scenario, 2027. The intent is to move that more towards 2025 or earlier, but it will all depend on how capable those missiles are in the fourth quarter of 2019.

Senator COTTON. You mentioned 499. That is to remain compliant with the Intermediate Range Nuclear Forces Treaty?

Lieutenant General OSTROWSKI. That is correct, sir.

Senator COTTON. So it is now acknowledged openly by the United States Government that Russia is in violation of the treaty. Of course, China is not a signatory to that treaty, nor is any other nation on earth, which means the United States is the only country that restricts its long-range missile development to under 500 kilometers. Do those restrictions inhibit the Army's ability to develop

a long-range precision fire capability that can outrange Russian and Chinese threats? Does it put our forces at a disadvantage?

Lieutenant General MURRAY. In terms of ballistic missiles, absolutely.

Senator COTTON. Thank you. Let us move on, General Murray, since you volunteered for that question, to the next modernization priority. The next-generation ground combat vehicle, we are still, as I understand it, in a very early stage and unclear whether it would be a vehicle to replace the Bradley or the Abrams or both, is that correct?

Lieutenant General MURRAY. Yes, sir, to be determined.

Senator COTTON. So what is the Army leadership doing to analyze feasibility for foreign vehicle designs or component systems for suitability in this program?

Lieutenant General MURRAY. Sir, right now, we are looking at all options to include foreign vehicle design and new development to be honest with you. You mentioned the Chiefs remarks not only at AUSA breakfast but in lots of other places, and he is very much focused on a 10X capability. He acknowledged some of the technologies do not exist, so some of the things we are looking for is alternative power, so get away from diesel turbine engines or piston engines. The Chief has been very clear on any future combat vehicle development will at least be optionally manned if not semi-autonomous or autonomous so commanders at the point of contact will have the option to send the vehicle forward unmanned or manned.

We are looking at the incorporation of probably simple AI at this point, so driver assist, 360 degree S.A., computer-assisted targeting and acquisition functions within the turret. We are looking at absolutely an integrated active protective system on the next-generation vehicle, whichever one it is and both, enhance lethality, a lighter weight so we get away—the weight issues we have with the current generation of combat vehicles, and whatever we come up with, we have to account for operations in dense urban terrain, which I think the Chief has said.

So that is a lot out there that may not exist right now, so what allies are developing, what Senator Warren said is being developed within the commercial industry, small business, universities, academia and the science and technology range, I mean, we have cast a wide net. But I go back to what I have said earlier; we cannot wait 20 years to develop this vehicle, so we have got to find a solution that we can develop fairly quickly that we can incorporate technologies as they mature in a relatively easy manner.

Senator COTTON. If we turn to the contrast in the prior round of questioning to the modernization programs in the 1980s, which by and large succeeded in the FCS [Future Combat Systems], which failed, one difference is that those 1980s programs were complementary and separate, not a single platform that was going to do all things for all people so that we if they failed like—I think there was an antiaircraft gun in the 1980s that ended up failing. You still have your utility helicopter, your attack helicopter, so on and so forth. Would this next-generation combat vehicle put us at risk of something like the FCS again that we are trying to build

a platform that can do multiple different roles? If it fails, then we fail across all those roles or functions?

Lieutenant General MURRAY. Potentially, and I think that is something we have to keep in mind as we go forward. I think—and I have read the report on the FCS. I think most of us have read the report on the FCS, and the Army senior leadership has committed not to make the same mistakes again. I think some of the mistakes we did is we bet on a technology and developed a platform around those technologies, and when those technologies did not deliver, the platform did not deliver.

The intent is, as we have said before, Senator, is figure out what is physically possible from a technology standpoint to do today before we go into development and to make sure we build the space into the vehicle to incorporate technologies that we know are coming in the future. We do not want to deliver something the day you deliver it, it is obsolete.

Senator COTTON. Let me turn to the third priority, active protection systems. Those are systems that are designed to protect vehicles from threats like RPGs or long-range antitank missiles. These are already fielded in Israel and Russia. The German army is beginning to acquire systems from one of its domestic producers. Sweden and Singapore are acquiring systems from Germany, and the United States Army has recently acquired three systems for testing for foreign and domestic designers, learning how to integrate their designs into Abrams, Bradleys, and Strikers. I think this is largely a good-news story, an example of how the Army can be more flexible and looking to foreign systems and commercially available systems. General Murray, can you discuss the status of this effort and the Army's recent position—or position on the recent DOT&E [Department of Operational Test & Evaluation] report that outlined some of the remaining technical challenges that we might encounter during the testing?

Lieutenant General MURRAY. Absolutely, Senator. So we bought a very limited number of the Trophy system. You said integrated. It is really not integrated. It is installed on the Abrams tank. We took it through characterization. We took a through mobility testing, Yuma Proving Ground. We had some issues we have worked through, and we are fairly satisfied with where we are on the Trophy system. That was phase 1, the characterization phase. Phase 2, the testing phase is really what DOT&E pointed out in terms of working through everything else we have to in terms of testing. But we are fairly comfortable with where we are on the Trophy other than it is installed. It is not an integrated system on that tank. It is added weight, it is added width, and so it has really just kind of compounded our problem. But it is—through characterization we are very satisfied with it.

Iron Curtain on the Striker and Iron Fist on the Bradley have had some issues over the last 6 months or so in terms of their characterization. It probably was to be expected. They are much less mature systems than Trophy was. Iron Fist is an Israeli system, and Iron Curtain is a domestically produced system. Iron Fist right now should—they have worked through their issues according to the engineers.

We should start characterization on that system down at Redstone Test Center probably the end of this month, maybe beginning of March, and Iron Curtain is finishing up its characterization. Then we are going to fundamentally have to make a decision on really all three systems but in particular the last two. Part of, you know, failing and failing early is the willingness to walk away, and so basically, on what we have seen, are those the systems we want or are they not the systems we want? If they are not, some of the other systems you mentioned we would be willing to go look at before we make a decision.

Then, ultimately at the end—and I just had a session on this yesterday—our integrated system, the MAP system (Modular Active Protection System), is our steppingstone of the future so that soldiers have common interfaces no matter what vehicle they are on. It gives a soft-kill, hard-kill capability. It gives a target acquisition capability so when you get shot at, you slew-to-cue. But it is the system that any effect or any radar, any EO/IR sensor can fit into, and it is completely integrated into the vehicle design.

Senator COTTON. Thank you. Talking to a fourth priority, air defense, General Anderson, I will return to you since we discussed earlier. It has been at least since the Korean War since the United States ground forces have kind of, under sustained aerial attack—obviously the threats that we face from China and Russia, though, could mean that that kind of threat would return. You mentioned, you know, taking Stingers out of the warehouses. Stinger and Avenger have been in service for four decades I think. How confident are we in the ability of those weapons systems to effectively counteract threats from Russia and/or Chinese aircraft?

Lieutenant General ANDERSON. That is why earlier there is no—we have never fought in this type of an environment, so what you are talking about, they are not capable, sir. So the issue becomes what is the next generation? Everything I talked to you about were additive things from sensors to radars and to provide some capability to give yourself a chance. But at the end of the day we have never faced something like that. So the issue becomes now, as we work the PAC-3 MSE, it has got to be in the munitions and it has got to be—and right now, it is a sheer function of—that is why when you talked about gaps earlier, we have got to restore BMD [Ballistic Missile Defense] capabilities at a much broader—we are short THAAD, we are short Patriot. We are moving—we are actually reallocating Patriots as we speak from one CCOM [combatant command] to another to deal with things on the Korean peninsula, and so that is the capability gap that we are focusing on in the near term as part of the modernization strategy. It is fires and BMD because we are shortchanged both by capability and capacity.

Senator COTTON. So better than nothing, which is largely what we currently have?

Lieutenant General ANDERSON. The Stinger thing was a purely—you know, it was amazing we pulled it off. It was a purely minimalistic approach to make sure that there was something. This also affects the Counter-UAS fight, so that is a whole different story, as you know, and there are about 19 systems. That is a good news story how the Army went commercial off-the-shelf, used other existing systems from other countries and gave our soldiers about

19 options, so everything from lasers to drone defenders to LIDS to, you know, AUDES, all stuff that has worked. That was a game changer pretty quickly in Iraq. Now, the question becomes how effective are they going to be in places like the Korean Peninsula, Eastern Europe?

Senator COTTON. Thank you. Let us turn to the fifth priority, which is kind of the opposite side of the same coin, future vertical lift and the vulnerability of our aircraft to enemy air defenses, in particular the Black Hawk replacement. There were some ambitious requirements that were laid out to travel twice as far and twice as fast compared to traditional helicopters in the same class. But at the same time, it is going to be facing a lot of new threats in terms of integrated air defenses and increasingly advanced manned portable air defense systems. What steps is the Army taking to make sure that that future platform can be survivable in that kind of environment?

Lieutenant General OSTROWSKI. Mr. Chairman, I can take that particular question. You are very familiar with the joint multi-role tech demonstrator that we have going on right now, two different aircraft both with Boeing and Bell. We have had the flights go on with Bell in terms of the tilt rotor aircraft, and we have hope that by late this summer we will see the Boeing compound coaxial helicopter in flight. The efforts and the information that we will gain from both those tech demonstrators will allow us to be able to move forward in terms of our priorities of capability sets, whether it be 1, 2, or capability set 3, which these are based upon.

Aircraft survivability with respect to that platform and our current fleet remains paramount to us. It is one of our top priorities within future vertical lift and the whole combat. So with respect to that, we are investing heavily with respect to the CMOS program, as well as getting after the ability to interdict the particular missiles while in flight. Now, this is tough because we are always shooting behind the duck. I think you know what I mean with respect to that. In order to defend an aircraft against a ground-based missile, you have to be able to confuse that missile. In order to do that, you must be able to take the steps necessary in order to create the software to execute that. That takes time and testing.

We have to go after kinetic capability, one that is not dependent upon software in order to defeat or dazzle the particular surface-to-air missile. That is what we are trying to get after. That is the next step. Just like we have APS [Active Protection Systems] for our combat vehicle fleet in the future in terms of that, we have to have APS for our aircraft.

Senator COTTON. What steps if any is the Army taking to promote the use of those future platforms across the joint force or with allied partners? I am always somewhat mystified when a multi-role, you know, workhorse is not as widely accepted outside of the Army as it ought to be.

Lieutenant General MURRAY. The current program is a joint United States Marine Corps/United States Army program. I would say very limited interest right now from allies because they are kind of waiting to see where we go with this. As General Ostrowski mentioned, the CFT, the future vertical lift CFT obviously is very focused on this in terms of are we on the right path, are we on the

right timeline, what are the critical capabilities we have got to look at? Because you mentioned, you know, we are looking for fundamentally different—we are changing the physics of rotary wing flight. To make sure we have got it right, that has become a focus, that we are on the right path to get there. I do think the joint multi-role demonstrator is potentially a way of doing things in the future. We have invested less than 50 percent, well less than 50 percent of the money to develop these demonstrators. This is mostly an industry nickel, which is I think probably the right way to go as we get into the future for other major programs.

Senator COTTON. How feasible would it be to have buy-in from the Navy or the Air Force for some of their rotary wing requirements? One constant question the subcommittee, in addition to the larger committee, explores, for instance, is the need for a rotary wing helicopter for the Air Force to maintain security and safety at its ICBM [Intercontinental Ballistic Missile] sites in the Western United States. Again, it is strange to me that a specialized helicopter is needed for that kind of mission.

Lieutenant General MURRAY. I would agree with you, Senator, but right now, I think it is very much—the other services, much like our allies, are waiting for us to kind of figure out where we are going to take this. I do think, you know, if we are successful, obviously it would be a very capable aircraft that would be obviously a multi-role aircraft. I think they are waiting to see how much the aircraft will cost, what the capabilities of the aircraft are because each service has unique capabilities that we require in our aircraft. For us, it is about mobility on the objective, to get soldiers on and off the objective. The Marine Corps have a slightly different priority, the Navy has a different priority, and of course the Air Force has a different priority for their aircraft. But I do think it will be a very capable aircraft that potentially could be utilized by all four services.

Lieutenant General OSTROWSKI. Senator, I would just add that this wheel has been created. The Black Hawk today the Air Force flies, the Black Hawk today the Navy flies, different variants and so forth. It was never a joint program to begin with, but the other services have adopted our material solution.

Senator COTTON. Sixth, networks, especially mobile networks, WIN-T [War Fighter Network-Tactical] and DCGS [Distributed Common Ground System], I think you are all aware that this is something on which I focused for many years. General Ostrowski, what is the plan to repair the mobile network?

Lieutenant General OSTROWSKI. Sir, again, our strategy is to halt those efforts in terms of WIN-T Increment 2 that we know are not going to work in a contested environment. We will build upon increment 1B, as we have. That is our system at the hull. We will buy modified pieces of Increment 2. In other words, what we have right now is for our NOSC [Network Operations Support Center] Light—our NOSCs and our TCMs, we have mobile capability, but it is capability placed on the family of medium tactical vehicles. We can shrink those down. We have been able to do so. That was just reported out in the DOT&E test that was released just recently with respect to NOSC Light and TCM Light. We owe that capability on the move to our SBCTs [Stryker Brigade Combat Teams]

and our IBCTs [Infinity Brigade Combat Teams]. We will move forward with the purchasing of that.

The rest of the money with respect to the network is going to go after the pivot and the fixed piece with respect to where we are going. I believe that you are aware that obviously we know what we have to do in terms of a network of the future. We have to find the transport mechanism, the transport layer first. That was clear in the IDA [Institute for Defense Analysis] report, and that is where we are going after. We have to modernize that piece. Once we get a transport layer and we decide what that is going to be in the future, we can then ensure that industry that wants to participate in our network of the future is able to link in to those standards and that architecture.

In the meantime, between that network of the future and now, we have to continue to be able to fight tonight, so that means fixing what we have, which is our current strategy, and then buying incremental capabilities that we are finding with respect to the soft community because we have teamed greatly with them, as well as the Marine Corps, and have several solution sets for the individual soldier and battalion and below that we are going to move forward to in terms of experimenting and prototyping to get at a medium or an interim capability while we wait for that next-generation network.

Senator COTTON. It seems like an area that is ripe for commercial off-the-shelf solutions.

Lieutenant General OSTROWSKI. That is absolutely correct, Senator. The bottom line is that is exactly where we are going. Eventually, we would like to hopefully get to a point where we can buy this as a service. Now, that is the Chief's vision. That is where we are trying to push these things towards, and that is why we want to continue to give problem statements to industry as opposed to being very specific with respect to our requirements. Allow them the freedom to be able to offer solution sets based on what they know in terms of the capable and reasonable in terms of technology.

Senator COTTON. General Anderson, I saw you nodding vigorously. Would you like to add anything?

Lieutenant General ANDERSON. No, sir. Watching this for a couple years and all the testing which you just said, it is as plain as day. The stuff is out there, and we are trying to reinvent the wheel. The Net Warrior is the perfect example, a phone with apps. Soldiers love it.

Senator COTTON. So if we could go back in time, we could just buy every soldier a smartphone and put some apps on it?

Lieutenant General ANDERSON. Just like your AT&T bill, do it for our soldiers, a personal device.

Lieutenant General MURRAY. That is one of the big initiatives, right? So they did not love it when it was a classified network, so one of the things we are looking at is how far down do classified networks need to go so the secure but unclassified network opens up all kinds of possibilities. You talk about commercial purchases. I mean, the key piece of Net Warrior is a mobile phone you can buy, you know, in the kiosk on the corner. I mean, that is the key piece of technology that is in that Net Warrior system.

Senator COTTON. Okay. A seventh priority, let us get down to the frontlines, soldier lethality. General Murray, there has been a proliferation of body armor, specifically Russian and Chinese, specifically designed to defeat traditional 5.56 NATO ammunition, which is of course what our soldiers fire from their M4s. What are we doing to address what is a very serious issue for the soldier on the frontlines?

Lieutenant General MURRAY. So we have several efforts ongoing, Senator. The first one would be the squad designated marksman rifle, which is the near-term gap. So that has a 7.62 capability that gives us the ability to penetrate the most advanced body armor in the world, along with the advanced armor piercing round that is in development. We are accelerating the SDMR [Squad Designated Marksman Rifle] or the squad designated marksman rifle to 2018, so we will start fielding that in 2018. We had hoped to accelerate the ADVAP round, the advanced armor piercing round, to 2018 as well to line up with that, but we are about a year off, so we will develop that ammo, field it in 2019. You can still fire 7.62 and you can still penetrate. You just cannot get quite the range you will with the next-generation round. That is phase 1.

Phase 2 is the development of what we are calling the next-generation squad weapon. The first iteration will probably be an automatic rifle to replace the SAW, which is also a 5.56. We have been pushed on the M27, which the Marine Corps has adopted. That is also a 5.56, which does not penetrate, so we are going to go down the path of next-generation squad weapon automatic rifle first to be closely followed, I am hopeful, for either a rifle or a carbine that will fire something other than a 5.56. It probably will not be a 7.62. It will probably be something in between. Case telescoping round, probably polymer casing to reduce the weight of it.

We have in the S&T community a demonstration weapon right now. It is too big; it is too heavy. But we have recently opened it up to commercial industry for them to come in with their ideas about how they would get to that. We have offered them some money to come in and prototype for us that type of weapon. We believe with that weapon with the new ammo we can achieve probably weights similar to the M4 5.56 ammo. The weapon will probably weigh a little bit more, the ammo will probably weigh a little bit less, and we can get penetration of the most advanced body armor in the world, probably well beyond even the max effective range of the current M4. That is what we see as a replacement for the M4 in the future, not the SDMR.

Senator KING. What is the time frame on that?

Senator COTTON. I think he said 2018 for the SDMR.

Lieutenant General MURRAY. When we started off—and, Paul, you can correct me—I think we were out around 2025 or 2026, and I think we are back to about 2023 now.

Lieutenant General OSTROWSKI. Yes, I would just say that between the S&T effort that we have ongoing with Textron and the OTA, other transaction authority, that we are going to offer to other vendors in 2018, the intent is to try to do a fly-off between those particular companies by the end of 2021 in order to provide some kind of capability by 2022 or 2023 at the latest.

Senator COTTON. What was 2018? Was that the new squad designated marksman rifle?

Lieutenant General MURRAY. Correct.

Senator COTTON. How does that differ from the rifle that was carried the last decade in Iraq and Afghanistan I think was in 2014?

Lieutenant General MURRAY. The EBR [Enhanced Battle Rifle]. It is a much better—the EBR was a modified and adopted M14, which was—it never got—I mean, it looked significantly different than anything else in the squad, so if you carried it, you looked like a target. This rifle was basically a variation of a sniper rifle so it is very accurate, but it is also capable of automatic fire.

Lieutenant General OSTROWSKI. It certainly looks a lot like an M4.

Senator COTTON. Okay. General Dyess, any thoughts beyond simply this question about penetrating Russian and Chinese armor, any broader thoughts about standard infantry squad kit and changes that might be coming to it?

Major General DYESS. There are a couple things, Senator. Night vision devices, I think that there is some activity that could go on there. Expanding the combat footprint of whatever size unit, let us say a squad or a platoon. The use of a small micro or quadcopters for air, which is a much less complicated environment than on the ground. I think that there will be most likely some ground robotics that are out there, but it is a much more complicated area than in the air. So I think that you will see maybe some expansion of the battle space and maybe awareness of small units and night vision are two other areas that I think on the soldier lethality part.

Senator COTTON. Putting the second one in layman's terms, a little drone with a camera on it?

Major General DYESS. That is correct.

Lieutenant General MURRAY. That is the equipment piece. I mean, there is also a significant effort going on in terms of treating the rifle squad as a weapons system. So we have continued to improve our own body armor, to lightweight it, to make it better. The weapons you have talked about, not only small arms but automatic weapons, antitank weapons, the Carl Gustaf, lightweighting that, and then probably as importantly is the nonmaterial solution, so how do we provide holistic fitness to, you know, what the Army exists to do, close with and destroy the enemy? How do we provide, you know, a—get the best and brightest and then provide them the holistic health and fitness and training materials? So in terms of simulations and synthetic training environments and how do you allow them to do multiple reps in some sort of very realistic synthetic environment so they get 100 reps before they go to battle for the first time?

Senator COTTON. If I could just dig a little bit more on that because it was my last question on this topic about outfitting the infantry squad, infantry platoon for enemy tanks and enemy attack aircraft. Obviously, that is not a consideration that has been foremost on our minds over the last 17 years on the modern battlefield. I mean, AT4s have been more about thinking who has to carry it in the STX lane. But if we are facing Russian and Chinese threats, they are obviously going to have main battle tanks and attack avia-

tion, so could you just be a little more detailed about that, General Murray?

Lieutenant General MURRAY. Yes, sir. I would start off by saying that no rifle squad fights by itself, and, you know, our experience in Iraq and Afghanistan I would never hesitate to send out a platoon by itself, but I never would send out a squad by itself just because of the combined arms effects of larger formations. If we are fighting that type of foe, I would guess in an ABCT [Armored Brigade Combat Team] I have got lots of antitank weapons, ways to deal with enemy tanks, SBCT less so but I have still got javelins and other ways of dealing with it. So really, the focus is the IBCTs, and that was part of the reason, although not designed to be toe-to-toe with a Soviet tank, is the mobile protective firepower to give the light IBCTs some ability to deal with targets that they are not organically equipped to do.

Senator COTTON. It is going to be down to the platoon level or—

Lieutenant General MURRAY. It depends on how the commander organizes them. It is one company per brigade, so it would depend on where that platoon was. Then there are other things like attack aviation that obviously can deal with—

Senator COTTON. Okay. General Anderson, one final modernization priority I would like to turn to you on—it was not addressed to my knowledge at the AUSA [Association of the United States Army] by Secretary McCarthy or General Milley—that is electronic warfare, Russian doctrine that is publicly available, say they view that as key asymmetric advantage against their adversary, namely us, both offensive and defensive. So, first, correct me if I am wrong but I do not think it was addressed by General Milley or Secretary McCarthy. If I am not wrong, why it was not, but also just give us an update on what the Army is doing to reconstitute electronic warfare forces and capabilities.

Lieutenant General ANDERSON. It is all things multi-domain, sir, and trying to get a strategy, you know, all things electromagnetic spectrum. So we have still got a couple stovepipes here between the E.W. community, the cyber community, the signal community, you know, and how do we achieve effects, and that is why this I.Q. as we establish an intel, cyber, electronic warfare space cell that we are going to task-organize with 17 fire so you have got the lethal piece, and then you are going to attack this new—different icons to get synergy between those capabilities, and then we will go test it, as Bo was talking about, out in Pacific pathways and the exercises to figure out what we can do. You know, but all we are doing right now in Europe is through the Rapid Capabilities Office is taking different electronic warfare kit, putting it together, and trying to again—it is a jamming capability. But the reason why electronic warfare is so important, if you cannot find where the stuff is emitting from, it does not matter because the jammer will not be able to figure that out. That is why the synergy between the two are so critical.

Senator COTTON. Okay.

Lieutenant General OSTROWSKI. I would just add, Senator, that the Rapid Capabilities Office has put situational understanding capability in Europe now, okay? What we have is one platoon per bri-

gade with respect to the second ACR [Army Cavalry Regiment], two on ABCT and 173rd Airborne Division. But what we have, sir, is a couple of different items. One is a VROD/VMAX which is a ground-based, soldier-based dismounted system that is able to D.F. signals of interest.

Sabre Fury is another capability. It is a mounted platform on a Striker, for instance, that also has line of bearing. Through that, the combination of those two efforts, along with Raven Claw, which basically is the computer that puts it all together, we have commanders able to have the situational understanding of signals of interest in their area. They then have the opportunity to do two things, either strike that particular capability with respect to indirect fires or they have the ability to jam it, a limited jamming capability. However, it is limited in terms of its jamming capability. That is the concern that we have. It does not stand up to what our foes, our near-peer and peer competitors, have in terms of their inventories, and that is the crux of the problem. We have taken risk in this area for too long.

Lieutenant General MURRAY. I think to add on to General Ostrowski, so none of that is the program of record. I think that is a great example, and it is really our Rapid Capability Office that is doing the prototyping and the demonstrating before we write a requirements document so we fully understand what is available and what it is we need.

Senator COTTON. Okay. Senator King?

Senator KING. One other question, as we were talking about all these systems, do you have any systematic red-team approach to trying to find flaws? In other words, somebody whose job it is to say why this will not work and to attempt to prove it, is that built into the system? I think that is often a valuable approach.

Lieutenant General MURRAY. There are plenty of people who say this will not work, and our Chief of Staff is probably, you know, first and foremost—

[Laughter.]

Senator KING. That is—

Lieutenant General MURRAY. But I am actually honest, Senator. So, you know, the one thing that has changed since I think it was NDAA '16 that the Chief back, you know, into the acquisition process—

Senator KING. In the process.

General MURRAY.—is that there is one person in the Army that questions our requirements and questions, you know, how fast we are going, whether what we do will actually work. It is the Chief. I mean, he is very involved. So if that was the intent of Congress to get the Army senior leaders involved in the requirements, in the acquisition process, it absolutely worked.

In terms of a formal red team, I mean, there is nothing I am tracking—

Major General DYESS. Just the experimental stuff, sir, that we do, where we put things in the hands of soldiers, and they have no restrictions in telling us what they think, and thank goodness for that.

Lieutenant General ANDERSON. If I could add, Senator, that was one of the benefits of not having a dedicated brigade for testing.

The last summer we did a test, we used a nonstandard brigade, and the soldiers were not afraid to say—they were not used to doing NIEs [Network Integration Education] every year. It was not the same unit, so when you introduced a new unit, they gave a lot more different perspectives than the unit at Fort Bliss did because they had seen this stuff multiple times, so there are benefits to rotating who the test unit is to get new hands on the equipment, new eyes on the kit, et cetera.

Senator KING. I think that is an important part of the process.

Lieutenant General ANDERSON. We did not see it that way at first, but it fell out that way.

Senator KING. Thank you. Thank you, Mr. Chairman.

Senator COTTON. The Chief has been very focused on these problems, and I think he has brought a very dynamic leadership to them. I remember when he first came on and we were speaking about the new Army pistol RFP, which was 350 pages, and he suggested that maybe we should just go to Fort Bragg and get a few gun lovers there to ask them what the best ones are and then go to Walmart or Cabela's and buy 50,000 of them. So we did not exactly do that—

Senator KING. We can get a deal, too.

Senator COTTON. Yes, we did not exactly do that, but it was much better than the 350-page RFP.

So I will close with the lesson that you can take away from that, I think. You know, Army doctrine says that leadership is the most dynamic element of combat power. Secretary Gates in his memoir of his time at the Department of Defense wrote about the relationship between Congress and senior department managers. Congress can only do so much. We can provide you the budgetary resources you need and some legal authorities, but usually, when Congress tries to solve a problem, it solves it with a meat cleaver, not a scalpel. In the end there is no substitute for leadership from the Secretary on down to the general officers and the programmatic leaders, and we really do depend on all of you and the men and women who work alongside you in the Department. So I want to commend you for the efforts that you have undertaken and encourage you to continue to do so to make sure that our modernization needs are fully met.

General Dyess, I assume this is your final testimony in front of the Congress?

Major General DYESS. Sir, I have not received any other notices yet.

[Laughter.]

Senator COTTON. General Murray, General Anderson, will this be your final appearance for some time?

Lieutenant General ANDERSON. My fate is undetermined, Senator.

Lieutenant General MURRAY. Mine as well, but if I have anything to do with it, yes, sir.

[Laughter.]

Senator COTTON. I will ask, so you are undetermined but General Dyess is not. I will ask you what is preferable, a day-one Ranger School recycle or congressional testimony?

Major General DYESS. I would rather come over here and talk to you, Senator.

[Laughter.]

Senator COTTON. All right. Gentlemen, thank you very much for your service to the country. Thank you for your appearance and your testimony. This hearing is adjourned.

[Whereupon, at 5:16 p.m., the subcommittee adjourned.]

[Questions for the record with answers supplied follow:]

QUESTIONS SUBMITTED BY SENATOR DAN SULLIVAN

JPARC FOR ADVANCED AIR AND GROUND JOINT TRAINING

1. Senator SULLIVAN. Lieutenant General Anderson and Major General Dyess, in the hearing I mentioned the lack of advanced air-land battle and training exercises and that General Milley has been talking about much bigger training exercises as a way to integrate the entire force with combined arms. There's an NDAA provision that takes a look at that. I asked if you considered the Joint Pacific Range Complex (JPARC) in Alaska, which has a land space the size of Delaware, airspace for fifth generation aircraft the size of Florida and naval sea space the size of Virginia.

You responded that you are conducting an exercise in May in Germany with participation from some of allied partners from the U.K., France, and Germany.

But this is a joint fight and you can't do that in Army-only ranges with just Army units. Would you agree that the JPARC is an ideal location for the type of advanced integrated training we will need to counter high-end and near-peer threats? How do you plan to utilize this amazing training space?

Lieutenant General ANDERSON and Major General DYESS. The Army recognizes the unique and important training opportunities at the Joint Pacific Range Complex (JPARC). The facilities and infrastructure within the JPARC can enable scenarios supporting advanced integrated training to counter high-end and near-peer threats. Readiness of joint formations to fight large-scale integrated battle campaigns is primarily the responsibility of combatant commanders and accomplished through joint exercises. The Army participates in integrated training at JPARC when Army Forces are required to support combatant commander or joint staff exercises. The Army has also used the JPARC footprint to carry out the United States Army Pacific's (USARPAC) Joint Pacific Multinational Readiness Capability (JPMRC) training events.

EVOLUTION OF MISSILE DEFENSE MISSION

2. Senator SULLIVAN. Lieutenant General Anderson, Lieutenant General Murray, Lieutenant General Ostrowski, for the past 60 years, U.S. Army Space and Missile Defense Command/Army Forces Strategic Command and its predecessors have served the nation advancing missile defense capabilities. The National Defense Strategy clearly prioritizes "missile defense" stating, "Investments will focus on layered missile defenses and disruptive capabilities for both theater missile threats and North Korean ballistic missile threats." In a new strategic environment where the "reemergence of long-term, strategic competition" with nations like Russia and China dominates on a "ever more lethal and disruptive battlefield," how do you see the U.S. Army's missile defense mission evolving and how will the U.S. Army work to ensure that critical defense capabilities—to include homeland missile defense sites and strategically located airfields—are fully defended against adversary aggression or coercion?

Lieutenant General ANDERSON, Lieutenant General MURRAY, Lieutenant General OSTROWSKI. First and foremost, the Ground Based Midcourse Defense (GMD) system provides the active defense component of our Homeland Defense against limited ICBM attack from rogue nations. The National Security Strategy and National Defense Strategy rely on our strategic nuclear forces as the foundation of a comprehensive deterrence against nuclear and non-nuclear strategic attacks from adversaries such as North Korea and Iran. Missile defense, an important component of this deterrence, addresses a limited conflict scenario and reduces the effects of a limited attack without encroaching on the strategic balance between near-peers. While current policy relies on deterrence to avoid conflict with near peer nations, we maintain our ability to develop and operate regional defense to protect our forces and reassure our allies and partners. The Army is looking at the missile defense mission using a holistic approach—one that addresses the entire life cycle of the threat. This

could reduce the cost of engagement by better leveraging offensive and defensive options, thereby increasing our survivability and interceptor capacity. Regionally, the Army is investing in cruise missile defense capabilities (Indirect Fire Protection Capability—IFPC), increased capacity in PAC-3 Missile Segment Enhancement (MSE) interceptors, and upgrading the Patriot force with both hardware and software, including development of an upgraded sensor (LTAMDS). The highest priority within the Army AMD force is the protection of the maneuver force. The Army is developing a capability to defend the maneuver force against unmanned aircraft and fixed/rotary wing aircraft.

EXTREME-COLD WEATHER TRAINING

3. Senator SULLIVAN. Lieutenant General Anderson, Lieutenant General Murray, and Major General Dyess, given the volatility on the Korean Peninsula, what actions does the United States Army need to take to ensure that the brigades operationally-controlled by USPACOM received the needed cold-weather equipment and training that allows them to survive, maneuver, fight, and win in potential contingency on the Korean Peninsula?

Lieutenant General ANDERSON, Lieutenant General MURRAY, and Major General DYESS. Combatant commanders and Army Force Providers determine unique equipment and training requirements for the theater and any specific operational tasks. ECWCS is a standard issue. The Army provides ECWCS New Equipment training to soldiers during fielding, including instruction and equipment fact sheets. Unit leaders are responsible for conducting sustainment training after initial fielding. The cold-weather found on the Korean Peninsula is just one of many conditions of the operational environment. Army commanders consider cold weather, mountainous terrain, urban environments as well as austere conditions as they plan training in support of deployments to the U.S. Pacific Command area of responsibility. The Army has pre-deployment training guidance to commanders to ensure brigades are prepared to maneuver, fight and win in varied conditions. U.S. Forces Command pre-deployment training guidance requires unit preventative medicine personnel or medical providers to conduct cold and hot weather injury prevention training for all soldiers prior to deployment.

4. Senator SULLIVAN. Lieutenant General Anderson, Lieutenant General Murray, Major General Dyess, does the U.S. Army have plans to look into sending platoon/squad leaders to the Northern Warfare Training Center (NTWC)—or a similar school—to ensure that, at a minimum, its leaders are trained in the basics of using the Extended Cold Weather Clothing System (ECWCS)?

Lieutenant General ANDERSON, Lieutenant General MURRAY, and Major General DYESS. The Army provides training opportunities for platoon, squad and other leaders and soldiers at the Northern Warfare Training Center (NWTC). At the NWTC they are trained in the knowledge and skills required to successfully conduct small unit operations in a cold, snow-covered environment. There are two courses offered there—a Cold Weather Leaders Course and a Cold Weather Orientation Course. Both place emphasis on the use of cold weather clothing and equipment. Training specific to the Extended Cold Weather Clothing System (ECWCS) is mission specific unit training. Army leaders at all levels are trained to identify factors that will leave soldiers more vulnerable to cold weather injuries. Proper wear and use of the ECWCS is one way to mitigate cold weather risks. Training on proper use of the ECWCS is an application of general principles of cold weather survival training and how to dress using layers of clothing to match the environment. Some Army Forces can conduct cold weather training at their home station, where they have cold weather climates, such as Fort Drum, New York, Fort Carson, Colorado, Fort Lewis, Washington, and at the Army Mountain Warfare School in Vermont. When units conduct cold weather training in below-zero temperatures, the training serves the additional purpose of providing soldiers an opportunity to practice wear of extreme cold weather gear. Wearing the gear while operating in sub-zero temperatures assists in increasing soldiers' confidence in their equipment.

QUESTIONS SUBMITTED BY SENATOR TED CRUZ

FUTURE VERTICAL LIFT

5. Senator CRUZ. Lieutenant General Murray, in 2011, the Department published Future Vertical Lift: A Strategic Plan for United States Department of Defense Vertical Lift Aircraft which made a compelling case for replacing the current fleet of vertical lift aircraft with new and advanced capabilities through 2050.

The report went on to say that most decision points for the DOD vertical lift fleet to either extend the life, retire, or replace with a new platform would occur by the mid-2020s.

I am encouraged by the Army's commitment to such a strategy through your Joint Multi-Role Technical Demonstrations (JMR TD) designed to investigate real design possibilities and technologies. I am also encouraged by the inherent joint nature of the program to date and the direction I see the Future Vertical Lift family of aircraft going in the future.

With the vast majority of DOD's vertical lift fleet, residing within the medium lift category, the Strategic Plan called for early decisions on Capability Set 3 aircraft. Are the Army's priorities still aligned with the DOD Strategic Plan for Future Vertical Lift with regard to Capability Set 3?

The JMR TD effort appears to have been a successful government-industry partnership to investigate new technologies and capabilities. Please describe JMR TD lessons learned and their applicability to the Army's future modernization efforts and FVL.

Lieutenant General MURRAY. The Army's current priorities are aligned with the Department of Defense (DOD) Strategic Plan for future of Vertical Lift with regard to Capability Set 3 and have been thoroughly intertwined in DOD's Executive Steering Group (ESG) chaired by the Office of the Under Secretary of Defense (Acquisition and Sustainment) and the Joint Staff J8, with General Officer membership from all of the Services. To support the ESG, the Army leads three of the four Integrated Product Teams (Science and Technology; Requirements; and Acquisition) developing the framework and documentation to support the Future Vertical Lift (FVL) Family of Systems (FOS). The Joint Multi-Role (JMR) program is an Army-led Science and Technology effort designed to demonstrate innovative vertical lift technologies to inform the FVL effort. The JMR air vehicles were designed to demonstrate critical technologies anticipated for Capability Set 3. The JMR Technical Demonstrations will reduce the overall risk to Capability Set 3, inform requirements development, reduce the time to mature technology during the Technology Maturation and Risk Reduction phase, and support critical program decisions, to include the Analysis of Alternatives completion and Milestone decisions. The FVL Cross Functional Team ("CFT") is also evaluating additional options and capabilities to address future peer/near peer threats and capabilities.

QUESTIONS SUBMITTED BY SENATOR RICHARD BLUMENTHAL

FUTURE VERTICAL LIFT (FVL)

6. Senator BLUMENTHAL. Lieutenant General Anderson, Lieutenant General Murray, Lieutenant General Ostrowski, and Major General Dyess, can you provide an update on how the Army's Future Vertical Lift (FVL) Program is progressing? What are you doing to develop the next generation of aviation platforms through the Future Vertical Lift Program? How can Congress best support these efforts?

Lieutenant General ANDERSON, Lieutenant General MURRAY, Lieutenant General OSTROWSKI and Major General DYESS, The Future Vertical Lift program will provide a family of vertical lift platforms that deliver next generation capabilities at the tactical, operational, and strategic levels. The FVL FOS currently consists of Capability Set (CS) 1 (Recon/Attack), Future Unmanned Aircraft Systems (FUAS), and Capability Set (CS) 3 (Utility/Lift). The FVL program is preceded by the Joint Multi-Role Technology Demonstration (JMR-TD) Science and Technology initiative with flight demonstrations scheduled to take place during fiscal year 2018 to fiscal year 2019.

- Capability Set 1 is an Armed Scout able to dominate maneuver and execute recon, attack and electronic warfare in peer/near peer conflict. The critical system attributes focus on increased Speed, Combat Radius, and Endurance while enhancing Survivability.
- FUAS is the next generation family of UAS focused on survivability, advanced teaming, multi-functionality, and optimized for Anti-Access/Area Denial.
- Capability Set 3 is the next generation Lift, Assault and MEDEVAC asset that integrates new technology, materials, and designs that increase speed, range and payload.
- FVL will integrate a common "Digital Backbone" across multiple platforms to provide rapid integration of future advanced capabilities to reduce the time it takes to field new capabilities to the warfighter.

- FVL will focus on affordable life cycle early and emphasize reliability and maintainability with the goal of increasing Operation Availability and reduce logistics footprint. In November 2016, the Army identified FVL as one of its key modernization priorities and was chartered as part of the eight agile cross-functional teams (CFT). The FVL CFT will leverage the expertise of industry and academia as needed to accelerated vertical lift capabilities requirements and disruptive technologies. Congress can best support the FVL effort by providing positive and stable support as well as fully funding FVL well into the future.

7. Senator BLUMENTHAL. Lieutenant General Murray and Lieutenant General Ostrowski, the Army's new Futures and Modernization Command is on track to stand up this summer, with the current plan to appoint a General Officer for each of the Army's Cross-Functional Teams (CFTs) across the six modernization priorities, with the exception of the Future Vertical Lift (FVL) team. Should the Army appoint a General Officer to oversee the FVL CFT?

Lieutenant General MURRAY and Lieutenant General OSTROWSKI. A general officer is assigned to lead the FVL CFT. Brigadier General (BG) Walter Rugen is the Director; he was in the process of being promoted to BG when he was assigned to the FVL CFT.

ARMY EUROPE: OPERATION ATLANTIC RESOLVE

8. Senator BLUMENTHAL. Lieutenant General Anderson and Lieutenant General Murray, can you provide us an update on Army Europe's Operation Atlantic Resolve efforts to deter Russia? What are the Army's plans for continued security cooperation exercises and interoperability training efforts with NATO allies and partners?

Lieutenant General ANDERSON and Lieutenant General MURRAY. The Army continues its heel-to-toe rotations of an Armored Brigade Combat Team (ABCT) and a Combat Aviation Brigade (CAB) which enhances deterrence capabilities, and increases the ability to respond to potential crises and defend our Allies and partners in the European community. The continued build of Army equipment sets for Army Prepositioned Stocks (APS) in the Netherlands, Belgium, and Germany, which will contain a division headquarters, two ABCTs, fires brigade, sustainment brigade, and other capabilities, provides United States Army Europe (USAREUR) additional combat power to quickly respond to potential crises in NATO sovereign territories. Through exercises such as Dynamic Front 18, Saber Strike 18, and Saber Junction 18, elements of the 2nd ABCT, 1st Infantry Division and 1st Cavalry Division CAB are conducting bilateral and multilateral training exercises in the Baltic States, Poland, Hungary, Bulgaria, and Romania to improve partner capability and interoperability, and assure Allies and partners. Collectively, these activities improve the confidence of our Allies and partners by demonstrating U.S. military capability and intent to compete against Russia's malign influence and indirect action in the region.

9. Senator BLUMENTHAL. Lieutenant General Anderson and Lieutenant General Murray, as the Army plans on conducting rotations for armored and aviation brigades into the foreseeable future, how do operations like Atlantic Resolve impact Army Modernization efforts? How are your efforts contributing to strengthening our deterrence capabilities? How can Congress best assist these efforts?

Lieutenant General ANDERSON and Lieutenant General MURRAY. The heel-to-toe rotations of Atlantic Resolve contribute significantly to our deterrence posture in Europe and continues to inform future modernization efforts across the Army. Through the use of European Deterrence Initiative (EDI) funding, operations like Atlantic Resolve highlight an increased demand for modernizing our long range fires, air defense, and other critical capabilities to counter Russian aggression. In addition to informing modernization efforts, the Army is placing its most modern equipment in Europe in support of Atlantic Resolve (e.g. Tanks, Bradley Fighting Vehicles, Self-Propelled Howitzers, Multiple Launch Rocket System (MLRS) Launchers, and Air Defense platforms) to further deter Russian aggression. Although the recent two year budget passed by Congress is an important step at more stable funding, Congress can best assist the Army by providing both predictable and consistent funding levels.

CYBER

10. Senator BLUMENTHAL. Lieutenant General Anderson, Lieutenant General Murray, and Major General Dyess, in addition to Secretary Esper, General Neller has stressed proficiency in traditional methods and skills by mastering basics in communication and navigation off the network to counter advanced adversaries.

How is the Army balancing the need to train off the grid, while also developing and deploying new, advanced technologies?

Lieutenant General ANDERSON, Lieutenant General MURRAY, and Major General DYESS. Based on the nature of today's threats, the Army continues to train and practice basic skills in communications and navigation while also providing soldiers advanced electronic systems and training. All Army Centers of Excellence instruct soldiers to develop and practice a communication Primary, Alternate, Contingency, and Emergency (PACE) plan. A PACE plan facilitates a soldier's ability to communicate in the event that one or more communication systems fail. With respect to navigation, at all basic, commissioning, and new officer and noncommissioned officer courses, soldiers are trained and tested on navigation without the aid of electronic devices. During other courses, such as Ranger School and Reconnaissance and Surveillance Leaders Course, additional periods of navigation instruction and testing without the aid of electronic devices are provided. In addition to training on degraded communications and navigation systems, institutional training on weapons that are .50 caliber and below begin without the aid of any electronic optical devices. Larger weapon systems, such as the M1A2 Abrams Main Battle Tank or M109A6 Paladin, rely significantly on electronics to engage targets. Courses at the Fires Center of Excellence and Maneuver Center of Excellence teach soldiers to identify and engage targets with their main gun in a degraded mode, or when there is a loss of electrical power. Additionally, the Army practices the concept of mission command. The purpose of mission command is to enable disciplined initiative within the commander's intent, and empower agile and adaptive leaders. Empowered leaders may make timely adjustments in response to changes in their operational environment in the absence of orders. Mission command allows the mission to continue in an environment where access to networks or electronics are degraded or denied.

11. Senator BLUMENTHAL. Lieutenant General Anderson, following reports of Russia targeting personal smartphones of NATO troops, what is being done to protect our soldiers and counter Russia's intrusions? What is being done to educate our soldiers?

Lieutenant General ANDERSON. United States Army Europe (USAREUR), as well as Commands across our Army, have produced briefs and training aids to assist commands in educating soldiers that there are both tremendous opportunities and vulnerabilities that accompany the convenience and capabilities associated with today's cell phones and personal electronics. Servicemembers are being educated to understand that they are vulnerable to four major threats in the cyber domain: cyber-attack, cyber espionage, cyber targeting, and cyber theft—including identity theft and criminal activity. Servicemembers realize that the threat from terrorist groups with global reach and ambitions, and the threat from criminal syndicates and nation-states in cyberspace is very real. Commanders at every echelon have the discretion to impose a prohibition on the use of personal electronic devices in conjunction with any and all official activities, including training and deployments. USAREUR soldiers, in particular, receive both Pre-deployment and Re-deployment Operations Security (OPSEC) training which includes vulnerabilities and threats to cell phones and other personal electronics.

12. Senator BLUMENTHAL. Lieutenant General Anderson and Lieutenant General Murray, while Russia's targeting of servicemembers for intelligence is not new, personal smartphones provide significantly more knowledge about a person than was easily accessible in the past. In what ways are you ensuring this vulnerability is not having an impact on our soldiers in Eastern Europe?

Lieutenant General ANDERSON and Lieutenant General MURRAY. United States Army Europe (USAREUR) maintains a robust Operations Security (OPSEC) program which requires both annual OPSEC training and continuous OPSEC awareness briefings. All rotational units receive both Pre-deployment and Re-deployment OPSEC training. The same OPSEC training is provided to soldiers permanently assigned to the European theater. OPSEC training is also provided to Family Readiness Groups. USAREUR has produced briefings and training aids to assist commands in educating soldiers on the tremendous vulnerabilities associated with personal electronics and to assist soldiers and family members with maximizing their personal electronics security settings.

IMPROVED TURBINE ENGINE PROGRAM (ITEP)

13. Senator BLUMENTHAL. Lieutenant General Ostrowski, does ITEP remain the Army's number one aviation modernization priority? What is the near and long term

development timeline for ITEP? Are you planning to fully fund ITEP in fiscal year 2019 and beyond?

Lieutenant General OSTROWSKI. The Army's Improved Turbine Engine Program (ITEP) remains one of Army Aviation's top modernization priorities. The ITEP will provide the current fleet of H-60 and AH-64 helicopters with a new turbine engine that provides significantly more horsepower, lift capability, endurance, and greater reliability. This will extend the viability of our current fleets as we transition to future capabilities. In the second quarter fiscal year (FY) 2019, the program is scheduled for a Milestone (MS) B decision. The Engineering and Manufacturing Development (EMD) phase includes the award of a contract to one vendor, and followed by platform/engine integration design. fiscal year 2020 continues both the EMD effort and platform/engine integration, A-kit development. fiscal year 2021 provides for First Engine To Test (FETT), and begins physical airframe integration. fiscal year 2022 will provide Preliminary Flight Rating testing, leading to an Air Worthiness Rating. In fiscal year 2023 we will conduct aircraft flight/qualification testing for both Apache and Black Hawk. In fiscal year 2024, the program is scheduled for a MS C decision with the award of the Low Rate Initial Production contract. In fiscal year 2026, the program will seek a Full Rate Production decision and achieve Initial Operational Capability in fiscal year 2027. The ITEP is meeting cost and schedule expectations and requirements remain stable. It is fully supported by Army leadership and fully funded through the POM.

F-35 INTEGRATION IN MISSILE DEFENSE

14. Senator BLUMENTHAL. Major General Dyess, as the Army modernizes toward a more lethal force, how does the Army plan on integrating the capabilities of the F-35 into its air and missile defense architecture—specifically ballistic missile defense? What actions will the Army take with the other services, who all field the F-35, toward incorporating the F-35 into missile defense?

Major General DYESS. The Army fights as part of a Joint Integrated Air and Missile Defense Architecture of which F-35 is already a part. In November of 2017, the U.S. Navy successfully integrated the F-35 with the Aegis Combat System and took a significant step toward enabling multi-domain capabilities among the Services. We anticipate the Services will be able to leverage the F-35's robust sensor suite capabilities to increase interoperability and enhance operational effectiveness. In particular, the Army will be able to leverage this recent and future F-35 integration with other DOD assets operating in the multi-domain battlespace to support cross-domain fires. Today the technical integration for ballistic missile defense is being led by Missile Defense Agency as the Technical Authority for the Joint Integrated Air and Missile Defense and within their responsibility for Joint engineering and integration. The Army will continue to ensure we learn and account for Joint contributions to air and missile defense in our requirements, architecture, prototyping and system development, in our learning venues such as experimentation and wargaming, and in our other supporting processes.

ARMY SHORT RANGE AIR DEFENSE ARTILLERY

15. Senator BLUMENTHAL. Lieutenant General Anderson and Lieutenant General Ostrowski, how does the Army plan on modernizing its capability gaps with short-range air defense artillery?

When will the Indirect Fire Protection Capability be operationally ready and deployable? Should the Army consider near-term options given the operational success of the Israeli Iron Dome, and could the Army utilize the United States variant of the Iron Dome system—known as Sky Hunter—to serve as an immediate stop-gap solution?

Lieutenant General ANDERSON and Lieutenant General OSTROWSKI. The Army is addressing the Short-Range Air Defense (SHORAD) capability gaps through Indirect Fire Protection Capability (IFPC) and Maneuver-SHORAD (M-SHORAD), providing a complimentary tiered and layered air defense. First, Maneuver-SHORAD is focused on defending a maneuvering force from Rotary Wing (RW), Fixed Wing (FW), and large Unmanned Aerial Systems (UAS) threats. In the early 2000's, the Army divested this capability and its Air Defense Artillery (ADA) due to the lack of credible air threat. In the near-term, we are planning to field four battalions by fiscal year 2022; the first battalion will be activated in fiscal year 2019. We are also now training Stinger teams to support Brigade Combat Teams, as well as modernizing the Stinger missile to increase capability against small UAS threats using a proximity fuse. IFPC is focused on defending more vulnerable fixed and semi-fixed assets from cruise missile (CM), RW, FW, UAS, Rocket, Artillery, and Mortar (RAM) threats. The first IFPC battery will be deployable in fiscal year 2021. In the mid-

term (fiscal year 2025), we envision combining the capability of IFPC and M-SHORAD into a composite battalion construct. We are also conducting Avenger modernization to extend the service life until IFPC is fielded to all seven Army National Guard (ARNG) battalions and three Regular Army (RA) battalions. The Army is currently conducting a Capability Based-Assessment (CBA) comparing IFPC, Iron Dome, and Norwegian Advanced Surface-to-Air Missile System (NASAMS) capabilities, in response to Congressional inquiries. More analysis is needed to determine the impacts of purchasing a non-U.S. weapon system and creating compatibility with our own networks/systems. As a foreign-designed, and largely foreign-built system, Iron Dome / SkyHunter does not have a viable near-term path for integration onto U.S. networks due to cyber security and compatibility challenges. It is also not compliant with United States Military Standards, including U.S. Insensitive Munition requirements, and is untested in alternative environments and for operations within the joint force Link 16 architecture. The primary capability gap that Iron Dome would solve is in defeat of the Rocket, Artillery and Mortar threat. The Army is currently mitigating this threat with the Land-Based Phalanx Weapon System (LPWS) which is operationally supporting deployed forces. IFPC will add an initial Counter Rocket, Artillery and Mortar capability in fiscal year 2023 with the Expanded Mission Area Missile (EMAM) (which includes SkyHunter as a candidate solution).

QUESTIONS SUBMITTED BY SENATOR GARY PETERS

STRYKER ECP

16. Senator PETERS. Lieutenant General Ostrowski, the Engineering Change Proposal for Stryker restores off-road mobility, increases electrical power, and improves the suspension and communications. This ECP provides enhanced capability and better serves soldiers. Will the Army continue to invest in these critical improvements for the Stryker fleet and ensure they are fielded rapidly?

Lieutenant General OSTROWSKI. Yes. The Army recognizes the advantages of the Engineering Change Proposal (ECP) for the Double-V Hull (DVH) Stryker. We are currently exploring options to apply the ECP to our current DVHs and the older flat-bottom Strykers that we are converting to DVHs. The overall intent is to ensure that all Stryker Brigade Combat Teams are equipped with DVH vehicles—as far as resources will allow.

STRYKER LETHALITY

17. Senator PETERS. Lieutenant General Murray, the Fiscal Year 2018 National Defense Authorization Act authorized an additional \$177 million for the Stryker lethality upgrade from the Army's Unfunded Requirements list. If funding to provide for a full set of 81 Strykers with the 30mm cannon upgrade is not provided in fiscal year 2018, would the Army support funds to complete that effort in fiscal year 2019?

Lieutenant General MURRAY. The requirement for Stryker lethality upgrades remains valid. If the fiscal year 2018 NDAA authorization levels for Stryker lethality are not appropriated, the Army would consider this requirement again for fiscal year 2019 relative to other high-priority unfunded requirements. The Army is currently awaiting feedback from the first Stryker Lethality fielding in Europe before determining a final lethality solution and procurement quantity. With two primary lethality Courses of Action available—30mm Medium Caliber Turret, or a Remote Weapon Station with Heavy Machine Gun and Javelin Missile—the Army's intent is to ensure that the appropriate lethality solution for the Stryker fleet is informed by all available means before committing to a specific lethality solution or mix of solutions.

SHORAD

18. Senator PETERS. Lieutenant General Murray, has the Army made a decision on increasing SHORAD capability, including basing it on an existing platform such as the Stryker of Bradley?

Lieutenant General MURRAY. The Army has made a decision on quickly increasing SHORAD capability. For the past two years the Army has emphasized the critical need to increase SHORAD capability, and the Army's CFT focusing on AMD has included Interim M-SHORAD modernization as its first priority line of effort. The Army will be leveraging the Stryker platform and has also increased the amount of SHORAD force structure to help fill this high priority capability gap.

HMMWV ROLLOVER

19. Senator PETERS. Lieutenant General Ostrowski, I remain concerned about the propensity for rollover accidents of HMMWVs, particularly when important safety technologies like Antilock Brake System (ABS) and Electronic Stability Control (ESC) are readily available for these vehicles. In my communications with the Army, I had been told that the Army was scheduled to begin incorporating these technologies in 1QFY18 but have recently been briefed that fielding these technologies has not yet begun and is not anticipated until July 2018. To date over 1,500 M997A3 Ambulances have been produced without ABS/ESC and I am concerned as production continues without addressing the risk of vehicle rollovers. How does the Army plan to award a contract to include ABS/ESC capability in production of HMMWVs?

Lieutenant General OSTROWSKI. Improving soldier safety in the Army's tactical vehicle fleet remains a priority, and the Army has qualified an ABS/ESC solution for the HMMWV. We received a proposal from the HMMWV manufacturer on 10 November 2017 for the inclusion of the Army-approved ABS/ESC Kits on the current HMMWV ambulance chassis production line. The rebuild will address current obsolescence issues with the power pack and other components, and will also add an Anti-lock Braking System and Electronic Stability Control (ABS/ESC) to improve safety by mitigating vehicle rollovers and other driving incidents. The Army is currently negotiating the award of this proposal, and we look forward to anticipated implementation in production in July 2018 and fielding to begin in November 2018 (consistent with available funding).

20. Senator PETERS. Lieutenant General Ostrowski, what are the plans for retrofitting HMMWVs produced without ABS/ESC and is the Army considering utilizing the qualified ABS/ESC solution which was originally designed as a retrofit kit?

Lieutenant General OSTROWSKI. The Army expects to pursue two approaches to equipping existing HMMWVs with the currently qualified ABS/ESC kit solution: (1) through a centrally-funded Maintenance Work Order (MWO) effort and (2) through unit-funded retrofit kits. A MWO would centrally fund and manage the retrofit of all HMMWV models to be retained as part of the enduring Light Tactical Vehicle fleet, although the proposed effort is not currently funded. The program office is also planning to make ABS/ESC retrofit kits available as an option for individual units, other services, and Foreign Military Sales customers-with kit purchase and installation funded at the unit level. We anticipate being prepared to execute both activities, subject to the availability of funding, NLT the end of fiscal year 2018.

**DEPARTMENT OF DEFENSE AUTHORIZATION
FOR APPROPRIATIONS FOR FISCAL YEAR
2019 AND THE FUTURE YEARS DEFENSE
PROGRAM**

WEDNESDAY, APRIL 18, 2018

U.S. SENATE,
SUBCOMMITTEE ON AIRLAND,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

AIR FORCE MODERNIZATION

The subcommittee met, pursuant to notice, at 3:31 p.m. in Room SR-222, Russell Senate Office Building, Senator Tom Cotton (chairman of the subcommittee) presiding.

Subcommittee Members present: Senators Cotton, Tillis, Sullivan, Cruz, Sasse, King, McCaskill, Warren, and Peters.

OPENING STATEMENT OF SENATOR TOM COTTON

Senator COTTON. Good afternoon.

On the Airland Subcommittee, we have been doing a series of hearings on modernization this year. Last time, we had the Army. Today we will focus on the Air Force.

There is no question that the ability to surveil and strike any target on earth is vital to our national security. We simply could not deploy our soldiers, sailors, airmen, and marines all around the world without the support of all of our airmen. That is why some cost overruns and time delays in modernization programs are troubling.

The F-35 recently finished its flight tests in the system development demonstration phase, but only after long delays.

We are also still waiting to receive the first KC-46 tanker, and we probably will not get it until later this year, which is over a year late.

I will say the B-21 has been coming along well so far, but given the track record, we obviously need to keep a close eye on it.

I will be particularly interested to hear our witnesses' thoughts on these three key programs. We have to get them right because as the National Defense Strategy (NDS) has put it, the biggest threat to the United States today is the emergence of long-term strategic competition by revisionist powers. What they all hope to revise, of course, is our role in the world despite their differences. Russian aggression, Chinese expansionism, North Korea's nuclear

program, Iranian backed terrorism—what they all have in common is they would like to stick it to the United States.

The only way we can keep the peace then is to prepare for a wide spectrum of contingencies. That means the Air Force needs to stay ahead of our potential adversaries, especially China and Russia, all while working under the continued constraints of the Budget Control Act (BCA).

I look forward to hearing from our witnesses on what capabilities the Air Force needs to maintain our lead, as well as how they plan to prioritize modernization given the constraints of the Budget Control Act.

I am also interested in hearing their thoughts on improving pilot retention, whose recent trend downward is a serious cause for concern.

Of course, the easiest solution to many of these problems would be to repeal the Budget Control Act in its entirety. The 2-year budget deal Congress passed earlier this year did some good, but under current law, Budget Control Act levels return in fiscal years 2020 and 2021. Congress has proven itself incapable of adhering to these caps. I do not think we should keep them on the books given the havoc they do to all of our modernization programs. I will say it again. Until Congress finally acts, the BCA must be repealed.

Now I would like to welcome our witnesses: Lieutenant General Arnie Bunch, Military Deputy, Office of the Assistant Secretary of the Air Force for Acquisition; Lieutenant General JD Harris, Deputy Chief of Staff for Strategic Plans, Programs and Requirements; and Major General “Smokey” Robinson, Assistant Deputy Chief of Staff for Operations. Thank you, gentlemen, for your many years of distinguished service and for joining us here today.

Senator King?

STATEMENT OF SENATOR ANGUS S. KING, JR.

Senator KING. Thank you, Mr. Chairman.

I want to welcome and thank our witnesses for their appearance today. I look forward to hearing your testimony about these important issues.

As the chairman mentioned, earlier this year we had Army witnesses to discuss the Army modernization portfolio, and today I want to see what you all have to say about the challenges facing the modernization of the Air Force.

I am especially interested in hearing how the Air Force plans to manage these multiple modernization programs to deliver the capabilities our warfighters need in a timely manner—I emphasize a timely manner—and defeat our most capable adversaries while protecting taxpayer resources. The recent track record in this is not good. Our job in Congress is to oversee the Department to ensure that we pursue these modernization programs in a more efficient and effective manner.

Our witnesses this afternoon face huge challenges as they strive to balance the need to support ongoing operations—and the chairman mentioned the problem with pilot retention, for example—and sustain readiness with the need to modernize and keep the technological edge, which is so critical to successful military operations.

Specifically, the Air Force will bear a large share of the burden of implementing the National Defense Strategy announced by Secretary Mattis earlier this year that identifies state strategic competition with increasingly capable adversaries as the primary U.S. national security concern. We are, in effect, shifting gears from one very different type of warfare to another.

These challenges have been made particularly difficult by the spending caps imposed by the Budget Control Act. Fortunately, we have a budget agreement on the defense top line for fiscal years 2018 and 2019, but additional challenges loom on the horizon with the Budget Control Act back in full force in 2020.

There are a number of other issues we need to discuss, but in the interest of time, I will stop here, wait for our discussion.

Again, I want to thank our witnesses and thank you, Mr. Chairman, for holding this hearing.

Senator COTTON. General Bunch?

STATEMENT OF LIEUTENANT GENERAL ARNOLD W. BUNCH, JR., USAF, MILITARY DEPUTY, OFFICE OF THE ASSISTANT SECRETARY OF THE AIR FORCE FOR ACQUISITION; ACCOMPANIED BY LIEUTENANT GENERAL JERRY D. HARRIS, JR., USAF, DEPUTY CHIEF OF STAFF FOR STRATEGIC PLANS AND REQUIREMENTS, HEADQUARTERS UNITED STATES AIR FORCE; AND MAJOR GENERAL BRIAN S. ROBINSON, USAF, ASSISTANT DEPUTY CHIEF OF STAFF, OPERATIONS, HEADQUARTERS UNITED STATES AIR FORCE

Lieutenant General BUNCH. Yes, sir. Good afternoon and thank you, Chairman Cotton and Ranking Member King and the distinguished Members of the subcommittee for the opportunity to appear before you today to talk about the Air Force priorities for fiscal year 2019. We appreciate your service and the support this subcommittee provides the United States Air Force, our airmen, and their families.

Today, as you said, I am accompanied by Lieutenant General JD Harris, Deputy Chief of Staff for Strategic Plans and Requirements, and Major General Brian "Smokey" Robinson, Assistant Deputy Chief of Staff for Operations. We have prepared a joint statement, and I will provide opening remarks for the team. But I would ask that the full statement be entered into the official record.

Senator COTTON. Without objection.

Lieutenant General BUNCH. For the past 70 years, your Air Force has been breaking barriers as a member of the finest joint warfighting team on the planet and has secured peace by providing decisive warfighting advantage in, through, and from airspace and cyberspace. Today's demand for Air Force capabilities continues to grow as the United States now faces a more competitive and dangerous international security environment than we have seen in generations. The fabric of Air Force weaves multi-domain effects and provides joint warfighters the blanket of protection and ability to power project America's full range of combat capabilities. We are always there meeting the rising challenges by defeating our adversaries, deterring threats, and assuring our allies 24 hours a day, 7 days a week, 365 days a year.

With global trends and intensifying pressure from major challengers, our relative advantage in air and space is eroding in a number of critical areas. We are supporting combatant commander requirements in response to growing challenges from Russia, China, North Korea, and Iran, in addition to the ever-present counterterrorism mission in the Middle East and around the world.

In accordance with the new National Defense Strategy, this year's budget request prioritizes long-term competition with China and Russia. The Air Force must build a more lethal and ready force, strengthen alliances and partnerships, and deliver greater, more affordable performance. Future wars will be won by those who observe, orient, decide, and act faster than adversaries in an integrated way across all domains.

With your support of our fiscal year 2019 budget request, the Air Force will drive innovation, reinforce budget discipline, and deliver capabilities with greater affordability at the speed of relevance.

The demand for air, space, and cyber capabilities continues to grow, and our Chief is committed to ensuring that America's airmen are resourced and trained to fight alongside our sister Services to meet all national security obligations. The Air Force seeks to balance risk across capacity, capability, and readiness to maintain our Nation's advantage.

I would like to thank the Members of this committee for the passage of the fiscal year 2018 budget and the relief of the Budget Control Act restrictions for fiscal years 2018 and 2019. This allows us to relook at some of the tough tradeoffs made between force structure, readiness, and modernization.

Today's modernization is tomorrow's readiness, and that readiness is not static. While our forces have been heavily engaged in deterring or addressing counterterrorism, other adversaries have taken the opportunity to invest in and advance their own capabilities. To address ever-narrowing capability advantages, we need your support in the form of steady, predictable, and timely appropriations that fulfill our annual budget requests.

The Air Force budget request for fiscal year 2019 builds on the progress we are making in 2018 to restore the readiness of the force, increase lethality, and cost effectively modernize our top priorities. This is critical to ensure we can meet today's demand for capability and capacity without sacrificing modernization for tomorrow's high-end fight against the full array of potential adversaries, allowing us ability to modernize faster, be ready sooner, be capable of achieving of our National Defense Strategy tasks in a timely manner.

As critical members of the joint team, the Air Force operates in a vast array of domains and prevails in every level of conflict. However, we must remain focused on integrating air, space, and cyber capabilities across the domains through our core missions of air superiority, space superiority, global strike, and rapid global mobility to continue to provide our Nation with the security it enjoys.

We look forward to working closely with the committee to ensure the ability to deliver combat air power for America when and where we are needed. General Harris, General Robinson, and I look forward to answering questions from the committee this afternoon.

Again, thank you for your continued support of the greatest Air Force on the planet.

[The joint prepared statement of Lieutenant General Bunch, Lieutenant General Harris, and Major General Robinson follows:]

JOINT PREPARED STATEMENT BY LIEUTENANT GENERAL ARNOLD W. BUNCH, JR.,
LIEUTENANT GENERAL JERRY "JD" HARRIS JR. AND, MAJOR GENERAL BRIAN ROBINSON

INTRODUCTION

Chairman Cotton, Ranking Member King and distinguished Members of the subcommittee, thank you for having us here today to continue our discussion on Air Force modernization. Additionally, thank you for your leadership and bringing fiscal stability back to our Government, departments, and agencies. Stable, predictable and timely funding levels are critical to arrest the readiness decline across the Air Force as we look forward to our future national security interests.

Today's demand for Air Force capabilities continues to grow with global trends and intensifying pressure from major challengers. The United States faces a more competitive and dangerous international security environment not seen in generations. Our relative advantage in air and space has atrophied in a number of critical areas and the projected mismatch between demand and available resources has widened. We require the right size and mix of agile capabilities to compete, deter, and win in this environment.

To ensure we maintain the advantage, the Air Force is increasing our fighter and tanker procurement with the intent to modernize the force. Additionally, we are moving towards the production of the B-21 to modernize our long-range strike fleet. We are also in the early stages of replacing a portion of our training aircraft, which will enable shorter training timelines and better trained aircrew. Efforts to modernize and extend the durability of some of our older aircraft and to provide increased capability to kill and survive in combat are currently underway. Finally, we are accelerating our efforts to deter, defend, and prevail against anyone who seeks to deny our ability to freely operate in space. Our fiscal year 2019 Budget proposal prioritizes long-term competition with China and Russia and moves the Air Force in the direction of multi-domain battle. It is focused on Readiness (people, munitions, FHP, WSS); Nuclear Deterrence (Bomber, ICBM, NC3); Cost-Effective Modernization (F-35, KC-46, B-21, T-X, UH-1 replacement); Air / Space Superiority (Air Superiority 2030, defendable Space, Electronic Warfare); Multi-Domain Command and Control (modernize E-3 AWACS, begin transition to Advanced Battle Management System); Light Attack (continue experiment, rapid prototyping); and Science and Technology (complete S&T strategy, long-term innovation).

For more than 70 years, your United States Air Force has secured peace by providing decisive warfighting advantage in, through, and from air, space, and cyberspace. Today's 670,000 Active Duty, Guard, Reserve, and civilian airmen meet these challenges by defeating our adversaries, deterring threats and assuring our allies 24/7/365.

DEFEATING OUR ADVERSARIES

Last year, your Air Force accelerated the campaign to defeat ISIS' physical caliphate by conducting more than 172,000 sorties and 98,000 precision air strikes—over 70 percent of the total in the campaign—to support Iraqi and partner forces in Operation Inherent Resolve. These strikes were enabled with Intelligence, Surveillance and Reconnaissance (ISR) missions. In 2017, the Air Force provided nearly 25,000 ISR missions and produced 2.55 million intelligence products that close intelligence gaps and support target analysis and development; almost 5 products every minute.

The Air Force's command and control missions ensures that the right info gets to the right person at the right time. Our E-8C Joint Surveillance Target Attack Radar System flew over 5,000 hours, enabling a range of support for Combatant Commanders from command and control in the ISIS campaign to the interdiction of over 12,500 kilograms of illicit drugs before they entered our Nation's borders.

Airmen transported nearly 1 million joint warfighters across the globe personnel and delivered over 738 million pounds of equipment and humanitarian supplies. Our tanker force extended joint power projection at intercontinental distances by passing more than 1 billion pounds of fuel in-flight, while aeromedical evacuation airmen airlifted more than 5,000 patients to safety. Closer to home, airmen helped combat multiple wild fires in the western United States and delivered 13,600 short

tons of relief supplies following the string of record-setting hurricanes in the North American hemisphere.

DETERRING THREATS

Last year, airmen conducted 16,425 intercontinental ballistic missile alert tours and 248 missile convoys across five states. Our bombers flew 580 missions (over 2,500 flight hours) in the Indo-Pacific, strengthening security and stability in the region and reassuring our partners. Reinforcing NATO's eastern flank, American bombers flew 70 assurance and deterrence missions (67 deployment missions and 3 global missions). In space, the Air Force operates six constellations and 12 satellite systems vital to national security that provide communications, command and control, missile warning, nuclear detonation detection, weather, and GPS for the world.

ASSURING OUR ALLIES

In the NATO-led mission in Afghanistan, the Air Force executed a sustained air interdiction campaign of over 4,000 sorties to support Afghan partners, decimating Taliban so-called safe zones, command and control nodes, illicit revenue-generating ventures, and logistical networks. In 2017, the Air Force engaged in more than 85 exercises with international partners, including five focused on high-end combat. We furthered the international role of the F-35, training with partners in both Europe and South Korea, and began delivery of F-35s to Israel, Norway, and Italy. Increasingly, we are conducting these missions with allies and partners.

READINESS

This steadfast watch, however, comes at a price. Continuous, worldwide combat operations since 1991 have taken a toll on our airmen, equipment, and infrastructure and the overall readiness of our Air Force. The relentless pace of non-stop global counter-violent extremist organization (VEO) operations for nearly thirty years affected high-end readiness for the Active Duty, National Guard, and Reserve forces. At the same time, our strategic competitors have closed gaps in capability and capacity. The new National Defense Strategy is clear: inter-state strategic great power competition, not terrorism, is now the primary concern in U.S. national security. Today's world requires an Air Force ready for great power competition. It is our top priority to restore readiness to win any fight at any time.

Readiness is first and foremost about having enough trained people. We continue to address the aircrew shortage through a multi-pronged approach. This budget boosts pipeline training capacity, expands pilot training and addresses experience shortfalls, continues incentive pay and bonuses, improves administrative support at the squadron level, and funds flying hours to executable levels. It also addresses gaps in space, nuclear, cyber, and intelligence career fields, and supports battlefield airmen, our air-to-ground integration force.

Thank you for your leadership in passing the fiscal year 2018 budget. Stable predictable funding is critical to addressing readiness. The fiscal year 2018 budget adds 2,300 Active Duty airmen and raises Air Force levels to 325,100. We will also add an additional 1,000 reservists and 900 guardsmen. We are focused on quality of life improvements for our airmen and their families: a 2.4 percent increase in military pay, a 2.2 percent increase in basic allowance for housing, and a 3.4 percent increase in subsistence. Growing our end strength to fill existing manpower requirements is the most important step to turn the corner and accelerate the climb to readiness recovery.

Training is another component critical to turning the corner on readiness. Through the fiscal year 2018 budget we will utilize \$6.2 billion to which funds 87 percent of the Total Force Flying Hour Program minimum training requirement and \$12 billion to fund key enabling weapons system sustainment (parts, maintenance and logistics) to near maximum executable levels. We continue to modernize our Operational Training Infrastructure with a blend of live, virtual, and "synthetic" platforms. This synthetic capability provides opportunities to test and train against the world's most advanced threats at a reduced cost and avoid unnecessary wear and tear on advanced platforms.

The Fiscal Year 2019 President's Budget, informed by and synchronized with the new National Defense Strategy, will accelerate our multi-year climb to full-spectrum readiness. The fiscal year 2019 budget will increase our Active, Guard and Reserve end strength by 4,700 airmen. We will address imbalances in critical fields like aviation, maintenance, ISR, cyber, and unmanned aircraft while also expanding our training capacity.

It is also critical that we increase pilot production and seasoning through expanded flying hour and weapons system sustainment programs. By extension, operational training infrastructure is needed to provide relevant and realistic training for multi-domain, full-spectrum readiness. The budget proposal funds aircraft depot maintenance, parts, logistics support, and invests \$2.8 billion in operational training infrastructure needed for relevant, realistic training for the multi-domain environment.

Those trained airmen will need munitions on hand. To support current operations and prepare for future requirements, this budget fully funds preferred munitions at industry capacity. This includes Hellfire missiles, Joint Direct Attack Munition bombs, the Small Diameter Bomb, and the Advanced Precision Kill Weapon System.

The Air Force is also significantly changing the way we collect operational tempo metrics. Prior methods underreport how much time airmen are away. By now accounting for temporary duties away from home station for training exercises or mission-related requirements in addition to deployment time, we more accurately capture the true impact of service demands on airmen, families, and home units.

The Air Force recruits airmen, but we retain families. In fiscal year 2019 budget we will continue supporting Air Force families with a military pay raise of 2.6 percent, increased housing and subsistence allowances, and bolstered family support programs. To improve family support, the budget funds expanded childcare hours, increases off-base childcare support, and funds more respite care and support coordinators for special needs families. We are improving the assignment system so families can better plan for future assignments, sustaining our morale and resilience programs, and implementing initiatives that support unit cohesion in our squadrons.

Today's modernization is tomorrow's readiness. Readiness is not static. It is inherently in decline or on the rise. These iterative efforts in fiscal year 2019 and beyond will accelerate the climb to full spectrum readiness and provide a force that is ready, lethal, and efficient in this era of great power competition.

FIFTH GENERATION FIGHTERS

Fighter fleet capacity is predicated on the capabilities of the aircraft that make up that fleet and thus, finding the right balance of fifth and fourth generation aircraft will remain fluid as we continually assess evolving threats. The "fourth/fifth" generation balance discussion is quickly becoming a "fifth/sixth" generation balance discussion and the fiscal year (FY) President's Budget (PB) 2019 adds \$2.7 billion over the Future Years Defense Program (FYDP) to fund the next generation of air dominance (NGAD) capabilities. Known as NGAD, this program will utilize an agile acquisition strategy in order to facilitate parallel development and prototyping activities that puts the Air Force on a timeline needed to close air superiority capability gaps identified in the Air Superiority 2030 Flight Plan. The Air Superiority Family of Systems will provide a complementary capability to the F-35A and will not impact JSF program objectives.

The F-35 program continues development of capabilities to ensure lethality and survivability against emerging high-end threats. The program recently delivered full (Block 3F configuration) warfighting capability and system development and demonstration is on track to complete this calendar year. The price per copy of an F-35A is now less than \$100 million and the fiscal year 2019 President's Budget procures 48 aircraft for the Air Force as the program readies to jump to 54 a year in fiscal year 2021. Fiscal year 2019 will also see the F-35 modernization program begin to shift to a Continuous Capability Development and Delivery (C2D2) acquisition strategy that will deliver continuous modernization, enhancements, and improvements that will deliver Block 4 capability.

The F-22, currently the only U.S. fighter capable of operating in highly contested environments, is also an integral piece of the Air Force's force structure modernization plan. Its stealth, super cruise, integrated avionics and sensors combine to deliver the Raptor's unique capability. We plan to retain the F-22 until the 2060 timeframe, and the fiscal year 2019 President's Budget reflects this commitment as we look to increase its capabilities and mission effectiveness through a myriad of modernization efforts. These efforts include sensor enhancements, datalink upgrades, open software architecture, enhanced GPS and the integration of a new helmet mounted display cueing system.

In fiscal year 2017, the Air Force continued experimentation efforts, including executing Phase I of the Light Attack Experiment. This was a live-fly event conducted at Holloman Air Force Base, New Mexico in August 2017 which assessed the military utility of various non-developmental, light-attack platforms. This first phase of the experiment allowed the Air Force to assess the potential of these off-

the-shelf, light attack aircraft to accomplish various permissive, close air support missions. The Air Force leveraged Other Transaction Authority (OTA) agreements, including industry cost-share agreements, to execute the experiment within five months of authorization. The Air Force plans to hold Phase II of the Light Attack Experiment in fiscal year 2018 as we develop the acquisition strategy for a potential procurement in the coming years.

Air Superiority, or the ability to control the air without prohibitive interference from an adversary, underwrites the full spectrum of joint operations. Increased threat capabilities, as well as the enemy's ability to engage in space and cyberspace, highlighted gaps in the Air Force's projected force structure. As a result, the Chief of Staff of the Air Force chartered the Air Superiority 2030 (AS 2030) Enterprise Collaboration Team (ECCT). The purpose of the charter was to develop capability options to enable joint force Air Superiority in the highly contested environment of 2030 and beyond. The charter examined and quantified needs, and explored materiel and non-materiel, multi-domain solutions to mitigate these gaps. Ultimately, recognizing that no "silver bullet" solution existed, the charter recommended the USAF develop a family of systems within five capability development areas: Basing and Logistics; Find, Fix, Track and Assess; Target and Engage; Command and Control; and Non-Materiel (Doctrine, Organization, Training, Materiel, Logistics, Personnel, Facilities, and Policy [DOTMLPF-P]). Developing next generation systems along these lines of effort is vital to ensuring Air Superiority in 2030 and beyond.

FOURTH GENERATION FIGHTERS

In addition to pursuing new capabilities and modernizing fifth generation fighters, the Air Force also seeks to extend the service life and modernize critical capabilities of key fourth generation aircraft. Doing so will help maintain Service capacity and readiness to meet the needs of the Warfighter while ramping up the F-35 production line and developing the Air Superiority Family of Systems.

The Air Force continues to assess fleet sustainability and alternatives for meeting warfighter close air support (CAS) demands, particularly in permissive environments. The A-10 has been the backbone of the CAS mission for more than 40 years and has proven to be the most cost-effective fourth generation fighter platform but has exceeded its original service life. This year the original A-10 re-winging program completes as the 173rd wing set will be installed later this summer. Additionally, a new re-winging program is on track to begin third quarter of fiscal year 2018 with the release of an RFP for up to 109 additional wing replacement sets. The new wing program will aim to avoid any further groundings beyond 2025 and will ensure a minimum of six combat squadrons remain in service until 2032.

To ensure the F-16's lethality and air prominence in permissive environments, we are pursuing an active electronically scanned array (AESA) radar upgrade that offers advanced capabilities and improved reliability and maintainability. We are also upgrading the mission computer, display generator, electronic warfare components, and the ALQ-131 self-protection jamming pod to enable advanced technology jamming techniques. Additionally, the legacy service life extension program (SLEP) will extend the F-16 airframe structural service life from the current 8,000 hours to 12,000+ hours, adding fifteen to twenty years of service for selected

F-16S.

Along with the F-16, the Air Force expects the F-15E to be an integral part of our fighters through at least 2040, and we are pursuing a new electronic warfare self-protection suite, the Eagle Passive/Active Warning Survivability System (EPAWSS) for the Strike Eagle fleet. The F-15C/D fleet is funded through the FYDP and will undergo multiple offensive and defensive upgrades to ensure its warfighting effectiveness until any recapitalization plans are completed.

BOMBERS

As with the fighter force, the total bomber inventory has also been significantly reduced. To provide perspective, in 1991 we had 290 aircraft available within the bomber fleet versus 158 B-1s, B-52s, and B-2s today. The current number is insufficient to meet Defense Planning Guidance and nuclear guidance while sustaining current operational demands and maintaining sufficient training and readiness capacity.

B-21

The B-21 program remains one of the Air Force's top priority programs with regards to investment in research, development, test and evaluation with \$2.3 billion

for Engineering and Manufacturing Development in the Fiscal Year 2019 President's Budget. The B-21 continues to make measured, positive progress and remains on track to deliver its initial capability in the mid-2020s.

The program successfully completed a Preliminary Design Review in 2017 demonstrating that the Air Force, along with its industry partners, are continuing to develop the design maturity of this platform. The development phase of the program is well on the path to detailed design.

The Air Force remains committed to a fleet size of a minimum of 100 B-21s. This fleet will provide capabilities necessary to meet future Combatant Commander requirements. The B-21 remains an absolute national defense priority, and we are grateful for your continued support of this critical program.

LEGACY

Until the B-21 is fielded, it is equally important that we continue the commitment to modernize our legacy bomber fleet to maintain the ability of our Air Force to provide Nuclear Deterrence Operations, Nuclear Response, Global Strike, and Global Precision Attack. The 20 remaining B-2 aircraft, currently the only low-observable, Anti-Access/Area Denial asset capable of penetrating advanced enemy defensive systems, are approaching 30 years of service and require engine, avionics, communications and defensive systems upgrades to maintain viability in the face of advancing enemy capabilities.

Similarly, the 62 remaining B-1s have been in service for nearly 35 years and are receiving upgrades to their avionics and flight systems, as well as an engine service life extension program. These upgrades will ensure the B-1's viability into the mid-to-late 2030s. The B-52H will continue its proud tradition of service through 2050, putting the remaining fleet of 76 at nearly 100 years of service. To sustain this venerable capability there are a number of modernization efforts currently in work to include new engines, replacement radar, improved/integrated avionics, weapons management, and communication upgrades.

MUNITIONS

Over the past year, the demand for munitions has continued to grow. To meet this demand, the Air Force continues to work with the other services and industry partners to efficiently ramp production capacity across the preferred munitions programs. The fiscal year 2019 Budget Request continues to leverage overseas contingency operations (OCO) funding to replenish the vast number of munitions expended to date in operations around the globe. The budget request also incorporates more Air Force base funding to build munitions inventories to support the National Defense Strategy and meet future operational requirements. As we work to expand the munitions industrial base, the Services continue to balance today's immediate needs with a long-term, sustainable capacity, ultimately fueling a more resilient industrial base for the future.

Hellfire missiles continue to provide a time-sensitive, direct-strike capability for our remotely-piloted vehicles and remain in high demand. Partnering with the Army, production capacity was ramped from 9,500 missiles per year in fiscal year 2018 to 11,000 missiles per year starting in fiscal year 2019. The Air Force plans to procure 4,338 missiles in fiscal year 2019. With the other Services' and critical foreign military sales (FMS) partners, the production line will remain funded to maximum production capacity for the foreseeable future.

The Joint Direct Attack Munition (JDAM) is also a weapon of choice for today's operators with an average of 50-70 expended daily to support ongoing operations. JDAM production capacity increased to 45,000 tailkits per year in fiscal year 2018 to meet the needs of the Services and FMS partners. The Air Force plans to procure 36,000 tailkits in fiscal year 2019 with Navy and FMS partners procuring the remaining 9,000 tailkits available in fiscal year 2019.

In another significant achievement, the Air Force teamed with the Navy and industry to rapidly procure and field the Advanced Precision Kill Weapon System (APKWS). The Services have teamed with industry to ramp production from roughly 2,700 guidance kits per year to 20,000 guidance kits starting in fiscal year 2019. The Air Force plans to procure 7,279 kits in fiscal year 2019.

Small Diameter Bomb I (SDB I) continues to provide precision, lethal strike capacity with reduced collateral damage effects and increased load-out per sortie for our warfighters. The Air Force has ramped the production line from 3,000 weapons per year in fiscal year 2015 to 8,000 weapons in fiscal year 2018. The Air Force plans to order 6,826 weapons in fiscal year 2019, with 1,174 weapons for partner nations. All of these production increases expedite the inventory replenishment of our critical munitions and build stockpiles.

As the Air Force responds to current operational demands, we are also looking toward the future to ensure we are prepared to defeat more advanced threats as directed in the National Defense Strategy. Advanced weapons capabilities are necessary to address sophisticated threat systems. The fiscal year 2019 Budget request reflects the Air Force's plan to continue investing in advanced weapon capability, specifically with the Advanced Medium Range Air-to-Air Missile (AMRAAM), Joint Air-to-Surface Standoff Missile-Extended Range (JASSM-ER) and SDB II. These weapons provide unique capabilities in a more contested, anti-access/area denial (A2/AD) environment.

Production of AMRAAM missiles, a critical air dominance weapon, remained consistent with fiscal year 2018 procurement levels as industry partners continue to work through parts obsolescence issues through the Form Fit Function Refresh (F3R) effort. JASSM-ER is the premier A2/AD weapon for striking advanced ground threat systems, and production will remain at maximum capacity in fiscal year 2019 and beyond. The Air Force plans to procure 360 missiles in fiscal year 2019 while also improving the weapon's capabilities and addressing upcoming parts obsolescence issues. Finally, SDB II enters its fifth and final low-rate initial production lot in fiscal year 2019, and in conjunction with the Navy, the Air Force's order of 510 weapons maximizes the production capacity as it prepares to ramp up in fiscal year 2020. Though not yet fielded, the SDB II will soon provide a key air-to-ground capability to kill mobile and fixed targets through adverse weather from standoff ranges.

INTELLIGENCE, SURVEILLANCE AND (ISR)

The RQ-4 Global Hawk provides a continuous, high altitude, long endurance, all weather, day/night, wide area reconnaissance and surveillance unmanned aircraft system. The Office of Secretary of Defense approved the RQ-4 modernization approach in September 2015 to include the MS-177 sensor integration, a Ground Segment Modification Program and a Communication System Modification Program. The MS-177 development and integration work began in November 2015 and the sensor is on track for Initial Operating Capability (IOC) in Third Quarter fiscal year 2018. The MS-177 will utilize the Block 30 Integrated Payload Adapter (IPA) that has been fully tested and can be applied to future modifications. The fiscal year 2019 President's Budget request is for \$309.5 million in investment dollars for this program.

The Ground Segment Engineering & Manufacturing Development (EMD) contract was awarded in July 2016. Installation of cockpits at Grand Forks AFB and Beale AFB will begin in Second Quarter fiscal year 2019. The Communication System Modification Program (CSMP) effort is in the Requirements Definition/Market Research phase. This program is finalizing requirements for modernization of Ground and Air Vehicle communications equipment, which will both improve communications capability and alleviate Diminishing Manufacturing Sources (DMS) issues with the equipment. We expect to release the Request for Proposal for CSMP in second Quarter fiscal year 2019.

The funding request for the MQ-9 investment dollars in fiscal year 2019 is \$1.2 billion. This program continues to modernize it's fleet and capabilities it provides to Combatant Commanders. It accomplishes this by sustaining the MQ-9 program of record and incorporating planned modernization efforts, while a separate program of record develops and tests those modernizations making them ready for the program at large. This process keeps the MQ-9s current and able to meet Combatant Commanders demands, while keeping an eye on the future for emerging requirements. Such efforts include the new Ground Control Station—Block 50 that is actively being developed, the new DAS-4 sensor package that will fly on the MQ-9 platform and the Extended Range enhancement to the MQ-9 Block 5 aircraft. Additionally, the MQ-9 program is actively engaged in a study to determine the actual service life of the MQ-9 platform. The first phase of that study will be completed in Summer 2018, with phase two being completed by fiscal year 2021. The results of this study will better inform the Air Force's decision on long-term sustainment of the MQ-9 program.

Gorgon Stare has been delivering Wide Area Motion Imagery (WAMI) in support of Operation Freedom Sentinel and Operation Inherent Resolve areas of responsibility since 2012. The Air Force has no plans to fund additional capability at this time but will sustain this MQ-9 podded WAMI capability in its current state. The fiscal year 2019 request is for \$76.7 million in Operation and Maintenance funding for this sustainment effort. The Air Force is migrating its primary ISR Processing, Exploitation and Dissemination (PED) weapon system, the Distributed Common Ground System (DCGS), to an open architecture. To support this effort \$454.8 million has been requested in the fiscal year 2019 President's Budget. The previous ar-

chitecture required 5–7 years of development, test, and fielding per major release. Open architecture will support software releases in weeks and months instead of years. This accelerated development and fielding timeline will enhance our ability to get inside the adversaries decision cycle, enable our ISR analysts to leverage cutting-edge analytic tools, and allow increased access to more intelligence sources and Intelligence Community capabilities.

MULTI-DOMAIN COMMAND AND CONTROL (MDC2)

An MDC2 capability generates effects that present the adversary with multiple dilemmas at an operational tempo that cannot be matched. The Air Force is focused on creating feasible investment options throughout its Battle Management Command and Control (BMC2) portfolio that drive towards the attainment of an advanced MDC2 capability for the joint force. To achieve this evolutionary shift, the Air Force is transitioning from a primarily aircraft centric to a net-centric approach using sensors across the battlespace linked by agile, resilient communications to provide the warfighter persistent capabilities across the full range of military options, uncontested and highly-contested, to meet the Nation's future needs. The key for future success is to establish a family of systems capable of integrating and fusing sensor information from all domains and bridging resilient communications across multiple pathways at all security levels.

To that end, the Air Force did not request funding in the fiscal year 2019 President's Budget for the Joint Surveillance Target Attack Radar System Recapitalization program. A recapitalized JSTARS platform will not be viable in future contested environments, putting the Battle Management Command and Control (BMC2) and Ground Moving Target Indicator (GMTI) missions at risk in a peer engagement. Therefore, the Air Force will embark on an alternative approach to fulfill the Combat Commander requirements for Ground Moving Target Indication and Battle Management Command and Control. The Air Force is pursuing a three-phased "incremental approach" to regain a strategic advantage and strengthen long-term lethality for the joint force. Increment 1 builds up resilience by incorporating technologies assessed at low technical risk and will continue to employ the current E-8C JSTARS fleet in the manner in which it operates today, and begins investment in agile communications and advanced sensors. The fiscal year 2019 President's Budget requests \$24.9 million in fiscal year 2019 and \$74 million across the FYDP to maintain the current E-8C JSTARS fleet.

Additionally, Increment 1 efforts include the Airborne Early Warning Contol (AWACS) weapon system as it evolves to integrate multi-domain inputs to provide air, land, and sea Battle Management and Command and Control (BMC2). The fiscal year 2019 President's Budget includes a request for \$471 million for the AWACS program. The Air Force is reversing its decision to divest seven AWACS and restoring the fleet to 31 aircraft. Additionally, multiple AWACS modernization activities are underway with the most notable being the upgrade to the Block 40/45 mission system which is the foundation for all future AWACS capability improvements. To ensure the United States maintains multi-domain dominance, the Air Force is initiating and integrating multiple communications upgrades such as improved Link 16, enhanced SATCOM, and resilient UHF radios.

Follow on Increments 2 and 3 in future budget requests will culminate in the full operational capability of the Advanced Battle Management System (ABMS). Increment 2 builds upon capability improvements by integrating advanced sensors and Open Mission System software into ground and air-based BMC2 platforms. This increment also fully incorporates joint and coalition sensors, as well as fifth generation aircraft sensors, which provide the ability to sense targets in highly contested environments. Finally, Increment 3 realizes the full potential of the proposed incremental approach with full operational capability of the ABMS. The ABMS system is envisioned to be an evolutionary leap in capability intended to achieve Initial Operational Capability in accordance by the the end of AWACS' projected service life in 2035.

The Air Force envisions the ABMS as an open architecture system, capable of ingesting new sensors and leveraging communications capabilities as the science and technology communities deliver them. Ultimately, the Air Force anticipates a more robust, resilient, reliable, and survivable architecture than currently exists. This open architecture will provide the means to integrate new technologies and create a more lethal force capable of operating in all environments. If we continue down last year's path, we will spend billions of dollars and end up with today's capability and capacity that will only be effective in small portions of the world.

The Air Operations Center (AOC) Weapon System (WS) interoperability with the MDC2 vision remains essential to the AOC way ahead. The fielded AOC WS 10.1

legacy system will not support the vision for MDC2 without significant improvement/modernization and the Air Force is still committed to fielding a modern architecture for the AOC that enables MDC2. The AOC WS 10.1 program is a sustainment effort fielding hardware and software to replace end-of-life or end of support components to keep the AOCs interoperable, supportable, and cyber security compliant while the Air Force continues to modernize the AOC enterprise. In response to Combatant Commanders' needs for rapid development of new capabilities in the current fight and to outpace our near-peer competitors, the Air Force initiated the AOC Pathfinder effort in August 2017, and subsequently terminated the AOC WS 10.2 program in January 2018. AOC Pathfinder seeks to rapidly deliver a subset of the AOC WS 10.2 requirements using industry software development best practices. These best practices include using cloud-native computing technologies, lean agile software development methodologies, and an entrepreneurial management structure. If the AOC Pathfinder proves successful, which it is showing great progress to date, its development approach will become the model for continued AOC modernization, and provide a system capable of being the foundation of MDC2 operations. The legacy AOC 10.1 infrastructure would then sunset by the end of fiscal year 2020, three years earlier than originally AOC WS 10.2 acquisition program. The fiscal year 2019 President's Budget request includes \$106.1 million in the AOC WS program element to support the AOC WS Modifications project which includes the AOC Pathfinder modernization efforts.

CYBER

The Air Force continues to build its contribution to joint cyber mission forces (CMFs) by developing the next generation cyber warrior, adding manpower for offensive and defensive cyber operations (OCO & DCO), and equipping them with the right capabilities to ensure effective operations. The Air Force is shifting from a 20th Century network-centric infrastructure to a 21st Century data-centric infrastructure. This transition will enable power projection through information integration and reallocation of critical Information Technology manpower towards emerging cyber warfighting missions.

The ability to effectively operate in cyberspace is vital to deliver airpower and conduct the Air Force's core missions. We are fielding and sustaining cyber resilient capabilities, which provide mission assurance against adept and continually evolving adversaries. The Air Force's strategic vision, which reflects Congressional direction, implements a multi-pronged approach providing assurance, resilience, affordability, and power projection within and through the cyberspace domain. These pillars enable the Air Force's assured cyber advantage to ensure our ability to fly, flight, and win in air, space, and cyberspace.

As Executive Agent for both Unified Platform (UP) and Joint Cyber Command and Control (JCC2), the Air Force is leading the growth of cyberspace capabilities for the DOD. UP and JCC2 are partnerships across all Services and with USCYBERCOM. UP integrates disparate cyber platforms to conduct full-spectrum (OCO & DCO) cyberspace operations, whereas JCC2 integrates joint, coalition and inter-agency command and control to enhance multi-domain operations. Rapidly delivering initial capability in fiscal year 2018 through Developmental Operations (DevOps), these programs directly enable the CMFs support to Combatant Commander requirements resulting in a shorter kill chain. Furthermore, the Air Force continues development of the Distributed Cyber Warfare Operations (DCWO) portfolio. This portfolio provides organic Air Force offensive cyberspace capabilities to hold adversary systems at risk, thereby enabling Air Force mission execution.

Signed in November 2015, our Air Force Cyber Campaign Plan (CCP) has two goals: 1) to "bake in" cyber resiliency in new weapon systems and 2) mitigate critical vulnerabilities in fielded weapon systems. It consists of seven Lines of Action (LOAs) which are designed to be the "engine" behind increasing the cyber resiliency of all Air Force new and legacy weapon systems. The CCP addresses the first goal by integrating cyber resiliency into the system engineering processes to 'bake in' resiliency before systems are fielded. It also institutionalizes adaptable subsystem architectures for enterprise technology baselines and business processes, when designing and building new weapon systems. Concurrently, the plan addresses the second goal by pursuing top-down and bottom-up methodologies to find and mitigate mission 'critical' cyber vulnerabilities. Other LOAs include cyber workforce development, creation of a cross-cutting common security environment, the development of counter cyber intelligence capability, and robust defensive cyberspace operations. AF DCO provides defensive cyber capabilities to protect Air Force missions against unwanted influence by an adversary.

We are committed to building out the Air Force's contributions to USCYBERCOM's CMF to support the Nation and the Department of Defense's Joint Information Environment (JIE) framework.

SPACE

The Air Force re-capitalized almost every satellite system in the space portfolio in the early 2000s. As those satellites transition to operations and space emerges as a warfighting domain, the Air Force is focused on fielding defensible, resilient, and more capable systems as soon as possible. Our National Security Strategy clearly states that unfettered access and freedom to operate in space are vital interests of the United States. The fiscal year 2019 Budget Request marks a bold pivot to support space warfighting and represents the Air Force's commitment to making wise, risk-informed, space superiority investments. The fiscal year 2019 President's Budget request for space investments of \$8.5 billion reflects a 7.1 percent increase over the fiscal year 2018 President's Budget and the Air Force's continued dedication to provide critical space-based capabilities to Joint and Allied warfighters. Our investments in these capabilities continue over the FYDP, an increase of over 18 percent from last year's FYDP will continue to improve space situational awareness, increase our ability to defend our Nation's most vital space assets, build more jam-resistant GPS satellites, improve missile warning, and expand partnerships to shape the strategic environment.

To counter adversary advances, the fiscal year 2019 President's Budget request transitioned the Space Based Infrared System (SBIRS) seven and eight procurement to funding the Next-Generation Overhead Persistent Infrared (OPIR) program to rapidly field a strategically survivable missile warning architecture by the mid-2020s. Next-Generation OPIR will serve as the core of an enterprise that uses space sensors to monitor space, air, land, and sea for infrared signatures. The delegation of Milestone Decision Authority back to the Air Force allows us to maintain flexibility in order to move fast to acquire this vital next generation capability.

The Air Force is also simultaneously modernizing all segments of our unparalleled Positioning, Navigation, and Timing capability through the acquisition of new space-based systems, the transition to a new ground segment, and the development of Military-code capable user equipment. GPS continues to be the world's gold standard for Positioning, Navigation, and Timing, delivering these vital capabilities to America's warfighters, civil users, and our allies around the world. The first GPS III space vehicle will launch later this year and will provide greater accuracy, new civil signals compatible with the European Galileo system, and enhanced military signal power. Earlier this year, the Air Force released a request for proposals for our future GPS satellites, known as the GPS III Follow-On (GPS IIIF).

The Air Force is also continuing its efforts with the GPS Next Generation Operational Control System (OCX), the ground system to command and control the next generation of the Air Force's GPS satellites. The OCX program will provide greater cybersecurity for the GPS enterprise, protecting a capability that is critical to the United States Armed Forces, the American economy, and billions of civilians. The OCX program is currently on track, most recently evidenced by the Air Force's acceptance of Block 0 capability, which will support GPS III launch and checkout, in October 2017. The Air Force is continuing to monitor the progress of the Block 1 and 2 system closely. Finally, the Air Force is leading the multi-service effort to provide more accurate and reliable PNT capability through the Military GPS User Equipment program.

The Air Force is modernizing the SATCOM architecture through the acquisition of both the ground and space segments—to include both free-flyer and hosted payload opportunities. We're also exploring new and innovative acquisition approaches and leveraging the acquisition authorities granted by the NDAA to procure these capabilities faster. We're working to partner with Norway on a hosted payload arrangement to provide a critical protected Polar SATCOM capability in 2022. Our partnership with Norway will allow the Air Force to provide a critical capability two years earlier and with an estimated \$900 million in savings over a free-flyer option. The Air Force is working to address future risks in our protected SATCOM enterprise with next-generation systems that meet both protected strategic and tactical requirements. For wideband communications, the Air Force is currently examining innovative acquisition approaches and partnering with commercial providers to ensure worldwide SATCOM coverage and capability.

While the Air Force continues to modernize our space- and ground-based assets, we are also committed to our unparalleled record of mission success in providing National Security Space assets a ride to space through our Evolved Expendable Launch Vehicle program. The Evolved Expendable Launch Vehicle program pur-

chases launch services from certified commercial providers to lift medium, intermediate, and heavy Department of Defense and Intelligence Community payloads into their intended orbits. In accordance with the law, the Air Force is moving to instill competition in our launch procurements while simultaneously working to transition away from the use of the Russian-built RD-180 engine through our Rocket Propulsion System Other Transaction Authority agreements. In our Launch Service Agreements strategy, we are working with industry through public-private partnerships to ensure the United States possesses assured access to space—that is, maintains two or more families of commercially-available launch vehicles—that satisfies National Security Space launch requirements.

The Air Force is committed to providing the Joint Force with critical space-based capabilities that will allow us to fight and win a war that extends to space. To enable this shift in warfighting posture, we are making investments in more resilient and survivable space architectures and employing unique acquisition approaches like Other Transaction Authority agreements, increasing the speed of acquisition decisions thanks to the newly-delegated milestone decision authorities, and partnering with industry to take advantage of technological advancements and best practices. We believe the fiscal year 2019 President's Budget request marks a turning point ensuring our space assets are defendable, resilient, and more capable and, we hope to continue our modernization and resiliency efforts with your support.

CONCLUSION

The demand for air, space and cyber continues to grow and our competitors continue to close technology gaps and negate our traditional advantages. In the midst of the challenges ahead, we will aim to keep these programs on track and deliver these systems—not only as a vital capability to our forces—but also as a best value to the taxpayer. The Air Force seeks to balance risk across capacity, capability, and readiness to maintain an advantage, however persistently unstable budgets and fiscal constraints have driven us to postpone several key modernization efforts such as UH-1N recapitalization and Long Range Stand-off Weapon. We are grateful for the recent fiscal relief, but we still face uncertainty. Sustainable funding across multiple fiscal year defense plans is critical to ensure we can meet today's demand for capability and capacity without sacrificing modernization for tomorrow's high-end fight against a full array of potential adversaries.

As critical members of the joint team, your U.S. Air Force operates in a vast array of domains and prevails in every level of conflict. However, we must remain focused and maintain our advantage in order to continue providing our Nation the security it enjoys. We look forward to working closely with the Committee to ensure the ability to deliver combat air power for America when and where we are needed.

Senator COTTON. General Harris, General Robinson, General Bunch spoke for both of you in that statement? Okay.

General Bunch, let us return to something you said in your opening statement about the need for certain and predictable funding. Obviously, the 2-year budget and the spending bill for this fiscal year has given you the money you need through the end of September, but does part of that need for certain funding mean a defense appropriations bill later this summer for the next fiscal year, fiscal year 2019?

Lieutenant General BUNCH. Sir, we always want appropriations on time so that we can wisely execute the contracts that we put in place and take the steps we need to make sure we can deliver the Nation's needs.

Senator COTTON. Thank you.

I also assume that the need for certain and predictable funding includes preventing the return of sequestration for fiscal year 2020 and fiscal year 2021, which is current law under the Budget Control Act?

Lieutenant General BUNCH. Sir, we are still recovering. We have started turning the corner, but we are still recovering from the sequestration readiness impacts that we faced in the past.

Senator COTTON. Thank you.

General Harris, let us turn and look at the big picture for the Air Force. It is an early stage of an extensive modernization and recapitalization effort, including the F-35A, the KC-46, the B-21 bomber, the new trainer, the new Air Force One, all of which will require significant research and procurement dollars. Investments in next generation air dominance capabilities have also begun to ramp up significantly, not to mention recapitalization of the nuclear enterprise.

How is the Air Force balancing all of these competing priorities?

Lieutenant General HARRIS. Sir, we do have a new National Defense Strategy to go with this budget, and while that document itself is classified, it allows us to take some risk in some areas.

With the budget that was awarded in 2018 and then moving out through 2019, what we are expecting based on the submission that we have, we are looking for a balance of continuing to improve our readiness but focusing more on the high-end fight against our peer adversaries rather than the focus of the last several years at the low-end fight for a counterinsurgency. That is a long list of things we have to get after.

We started with our nuclear mission to make sure that that is number one. We have funded and covered as much of that as we can. We continue to make progress and making sure that it is connected and ready for the fight that we are trying to deter, but our focus is on that high end across with the B-21, the F-35, our next generation air dominance, to make sure that we are ready to fight our adversaries the way we would expect to from a highly contested war.

Senator COTTON. You somewhat anticipated and preempted my next question, which was how is the National Defense Strategy going to affect your modernization and recapitalization plan. It sounds like that focus on the high end is one change. It is the last National Defense Strategy.

Lieutenant General HARRIS. Yes, sir, it has. The National Defense Strategy told us to take some risks in areas where it was either not cost effective to modernize some of our capability, to look at other ways to do things and to certainly make sure that we are focused for that high-end fight against some of the adversaries that are listed in the NDS. It was helpful in that it gave us areas to take risks. You saw that in space with one of our big moves with our SBIRs [Small Business Innovation Research Program] effort where we have restructured our final two SBIRs seven and eight to make sure that we could both defend the assets we have on orbit and make sure that we could hold an adversary's capability in space at risk also. You see that in the JSTARS [Joint Surveillance and Target Attack Radar System] effort that we have done to make sure that it was a survivable capability for the mission that we need, and where we are headed with the recap was not necessarily in support of the National Defense Strategy in the task we have.

Senator COTTON. How are you managing all those priorities with the prospect that BCA sequestration levels may return in fiscal year 2020, which is now no more than 18 months away?

Lieutenant General HARRIS. Sir, to be honest, a return to BCA sequester from that perspective would be devastating to our plans. I think the Chairman of the Joint Chiefs of Staff said it well. To

execute and continue on where we are at, we need about a 3 percent increase. To execute the NDS strategy, it needs about a 5 percent increase. We are planning for a flat line budget not a return to BCA, and that is what is handcuffing us getting after some of the readiness and modernization and the capability that we need and the capacity that is expected of our joint teammates.

Senator COTTON. One final question in this round. The Air Force leadership has stated on numerous occasions that the Air Force requires a minimum of 100 B-21 bombers. Has the National Defense Strategy done anything to change that requirement?

Lieutenant General HARRIS. I would not say it has done anything to change it, sir. It has probably reinforced that requirement that 100 is the minimum based on what we are going to need out of that capability.

Senator COTTON. Thank you.

Senator KING?

Senator KING. Thank you.

General Bunch, let us talk about the F-35 for a minute. I understand that there is a dispute about priming some of the drains on the entire fleet of aircraft. This was not done on the production line. It has been identified as a problem. First, give me an update on what the situation is with accepting F-35 deliveries.

Lieutenant General BUNCH. Sir, Senator King, what we have done is put a pause. I would not call it a complete stop. Some of the lot 10 aircraft have been accepted, 14 to be exact. There are five that are in hold right now. Three of those are Air Force. One of those is from Norway and one of those is from Australia. We have taken this step as we negotiate and work with Lockheed Martin on how we do the remediation of that error.

Senator KING. Do all the planes that have been produced have this problem?

Lieutenant General BUNCH. No, sir, not all. We found it on a lot of the ones, though, that are in the fleet, and it is something that we need to go retrofit.

Senator KING. So the ones that are in production are being—

Lieutenant General BUNCH. Yes, sir. The ones that are in the line are being fixed, Senator.

Senator KING. I see. Okay. We are talking about 14 airplanes?

Lieutenant General BUNCH. No, sir. We are talking more aircraft than that that have gone to the field. I cannot give you the exact number right now, and if I need to give you a number, we can go back and work that with the program office. But it is an escape, quality escape, on taking those steps in putting that corrosion protection in that area. It was found on an aircraft that was in the field. It is something we found in other places, and it is something we are right now working. Admiral Winter is working with Lockheed Martin to negotiate how we get that resolved.

Senator KING. I understand just in the last couple of days that Lockheed Martin may be refusing to do this work without reimbursement from the Government. What is the Air Force's view on that?

Lieutenant General BUNCH. Sir, right now our position is I need Admiral Winter to be the program executive officer and stand up

and take this step to make sure we are getting a quality product and make sure we are getting something that we can afford.

Senator KING. I am not sure what you just said.

Lieutenant General BUNCH. What I really said is Admiral Winter is working this for us to work the remediation so that the contractor has to step up, which we support.

Senator KING. So it is your position that this is the responsibility of the contractor?

Lieutenant General BUNCH. That is my position, sir.

Senator KING. Thank you.

Let us talk about the KC-46. I understand there are further delays there. Can you give us an update on where we are with the certification process?

Lieutenant General BUNCH. The certification process continues. It is delayed from what we had expected. We have run into issues with getting the FAA [Federal Aviation Administration] certifications through the process, and we have had delays in flight test execution.

Senator KING. Is this a contractor delay, an Air Force delay, or an FAA delay?

Lieutenant General BUNCH. It is a contractor delay because they are responsible for getting it through the certification process and delivering an aircraft, sir. So that FAA certification is a process they have to go through with the FAA to get approved, and they have not been able to accomplish that.

The test delays are a program that we have not executed as a team to the level that we are supposed to execute. That is something that we are in discussions about how we prioritize and how we resource to make sure that it gets executed as quickly as possible. The latest estimate right now is the end of this year for the first aircraft delivery. We continue to have regular meetings and work with Boeing to see what we can do in parallel. We continue to work what we can do in the test program to expedite. Can we add additional resources? Can we rephrase how we do certain tests? But our end game is we need an aircraft that when it is delivered is capable of the mission and we have something we can put our airmen in and our maintainers working on so that we can execute missions day one.

Senator KING. You are looking toward deliveries beginning at the end of this calendar year?

Lieutenant General BUNCH. Yes, sir. That is our estimate. We are trying to pull it left, but that is our estimate today, sir. I apologize for interrupting.

Senator KING. Do you think that is realistic, you can make that?

Lieutenant General BUNCH. Sir, we are still executing the test program. We still have a long way to go. I am optimistic today. I need to see the program continue to execute, and I need to see the performance continue to improve with a number of test points we are executing on a regular basis.

Senator KING. Now the other big project, the B-21.

Lieutenant General BUNCH. Yes, sir.

Senator KING. There may be material that we have to talk about in a closed session, but what can you tell me about the progress and the Air Force's understanding of where we are and if you are

satisfied with progress to date both in terms of timeliness, capability, and cost?

Lieutenant General BUNCH. Sir, I am satisfied today with our progress. We continue in the MD [missile defense] program. I think we have reported before we completed preliminary design review. We have now completed a first software drop to go through the process, and we have software out that we are looking at now. They are already working on the second drop. We continue to have regular meetings with them and measure the progress, give regular updates to senior leaders, but right now I am very happy with how the program is progressing.

Senator KING. And it is falling within the parameters of the contract in terms of cost?

Lieutenant General BUNCH. It is falling within the parameters of what we estimated the cost would be because, if you recall, we did our independent cost assessment. We estimated what we thought it would be, and it is falling within those parameters today.

Senator KING. Good. Thank you.

Lieutenant General BUNCH. Yes, sir.

Senator KING. Mr. Chairman, thank you very much.

Senator COTTON. Thank you, Senator King, touching on several of the key questions that every member of this committee has.

Senator Sullivan?

Senator SULLIVAN. Thank you, Mr. Chairman.

Gentlemen, welcome. Thanks for your service.

I want to continue on with the KC-46. How long has it been delayed? What was the original target date?

Lieutenant General BUNCH. Our original target date for the first aircraft, we were actually going to get required assets available by August of 2017. That was what we had put on contract. That was going to be 18 aircraft, 9 work ship sets—that is wing, air, fuel, and pod ship sets—and 2 spare engines. Currently we estimate that in February of 2019 at best.

Senator SULLIVAN. So a 2-year delay at minimum?

Lieutenant General BUNCH. That is about an 18-month delay, sir, but it has been significantly delayed. We actually are expecting first aircraft delivery late this year.

Senator SULLIVAN. You gave us a little bit of generalities. Can you get more specific on the source of the delay?

Lieutenant General BUNCH. Sir, the requirements to get through the certification process has taken significantly longer than we originally scheduled and what Boeing thought they were going to be able to execute working with the FAA and doing those certifications. That has taken significantly longer.

We have discovered things in flight tests. Over a year ago, we had a boom load issue. That has been rectified. Right now, we have three category 1 deficiency reports that we are working through. We have a category 1 deficiency report on the centerline drogue system and how it refuels the F-18. We have a category 1 deficiency report—

Senator SULLIVAN. Category 1 is?

Lieutenant General BUNCH. I apologize, sir. I went into acquisition speak.

That is a deficiency that is significant enough that we need to see it fixed and we need tactics, techniques, and procedures or mitigations work before we will be able to accept that capability.

Senator SULLIVAN. Who bears the financial burden of these delays?

Lieutenant General BUNCH. On this program, sir, the cost is capped at \$4.9 billion. We have already far exceeded that. So all of this expenditure is being done on Boeing.

Senator SULLIVAN. Okay. We had a lot of lessons learned, I am assuming, from the F-35 acquisition and delays and how long that took. Are we applying any of those to what is going on with the KC-46 right now?

Lieutenant General BUNCH. The KC-46 is a different contracting strategy, and it is a different asset.

Senator SULLIVAN. There are no lessons learned from the F-35 to this situation?

Lieutenant General BUNCH. There are probably some lessons learned about how you build your strategy from the very beginning, who you have involved, and how you make your assumptions. The difference on the two programs, the F-35 program was a cost-plus program that has caused us to continue to invest money in that program. On the KC-46 program, that was a fixed price, incentive firm contract, and when we reached the cap for that, we no longer are expending funds. We are paying for some of our test force and other things, but all of the overruns Boeing is paying for.

Senator SULLIVAN. In my State we are going to have over 100 fifth generation fighters when the F-35's get there and the F-22's and JPARC [Joint Pacific Alaska Range Complex]. I will talk to you in a minute about that.

In both the Secretary and General Goldfein's confirmation hearing, they committed to me to take a hard look at the OCONUS [outside the continental United States] decision on the KC-46 basing in Alaska. Can I continue to get your commitment on that, General, to take a look at that?

Lieutenant General HARRIS. Yes, sir. We have made no change, and we will continue to look at it.

Senator SULLIVAN. Let me ask on the JPARC. With the fifth generation aircraft and the need for bigger training, a number of the senior Air Force leadership has referred to that training space as the crown jewel given its size and the joint training and the combined arms training.

But the one thing that I think a number of you—and it was even in Secretary Wilson's confirmation, the QFRs—what we lack there in terms of the most realistic training is up to date equipment. Emitters, in terms of the threat emitters are more representative of the Vietnam era and the first Gulf War. Secretary Wilson stated that she believed there are plans to add joint threat emitters and advanced radar threat systems to JPARC to make that the top, most realistic. Is that ongoing? Can you confirm her commitment that she made during her confirmation hearing on that? General Robinson, it looks like you got this one.

Major General ROBINSON. Yes, sir, Senator Sullivan. A great question. The short and the long is we actually have an operational training infrastructure road map that we have spent quite a bit

amount of time researching the best way to optimize training for our fifth generation platforms in terms of the right threat emitters and replicating the threats that you talked about physically, as well as virtually. We are aggressively looking at how we can do that.

Senator SULLIVAN. So is that a yes?

Major General ROBINSON. Yes.

Senator SULLIVAN. Would you agree, given the importance of fifth gen—I know we have notional training but actual air-to-air, real steel up in the air that having much larger air spaces is so important given the standoff ranges on fifth generation fighters that we need to make sure we are training. Would you agree that is important as well?

Lieutenant General HARRIS. Yes, sir, we do. The JPARC is one of those crown jewels that provides a magnitude in what we need for a lot of that.

Senator SULLIVAN. Air space bigger than Florida. You knew that but I am not sure my colleagues did.

Lieutenant General HARRIS. Yes, sir. I enjoyed my time at Eielson Air Force Base for 2 years, so I am familiar with it.

We are supportive and will continue to work to make sure that we get the training that we need. But as you know, the F-35 and the F-22 are very sophisticated capabilities that they see through a lot of the threat that is not an actual piece. We are having to work through that on our training also.

Senator SULLIVAN. Great. Thank you.

Thank you, Mr. Chairman.

Senator COTTON. Senator McCaskill?

Senator MCCASKILL. I know that you all would like to go back and change the decision. I am so proud of the Navy pilot that was piloting the Southwest flight and was able to land that plane. She tried to be in the Air Force first, and you guys were not taking women pilots at the time. I am glad that we have rectified that throughout our military since, obviously, she showed tremendous skill and poise at one of the most critical moments a pilot could ever face. I had to tease you a little bit about that before I began my questions.

Have any of you had a chance to read the DOD IG [Inspector General] report on F-22 modernization that came out last month?

Lieutenant General HARRIS. Yes, ma'am. We have the report.

Senator MCCASKILL. Could you tell me if the issue that they identified about implementing agile software development methods on weapon system acquisitions—if those issues that they point out—have they been addressed?

Lieutenant General BUNCH. Ma'am, we had already identified those issues and had started taking steps. We are implementing agile developmental ops procedures in that platform to try to accelerate capabilities to the field. Those steps were taken before the report was ever published.

Senator MCCASKILL. Do you believe that all of the issues that are identified in that report have now been taken care of? Can I go through my IG list and check all of those off?

Lieutenant General BUNCH. I believe, ma'am, we have addressed those issues. There were certain things they had in we did not con-

cur with exactly the wording they had there, but I am very comfortable and I have emails even on it this week as to how we move forward to be more agile and how we do that software development to move forward and provide those capabilities more quickly at the speed of relevance into the field.

Senator MCCASKILL. As always when you have a disagreement with the way a finding is—as an old auditor, I am picky about this. If you disagree with the way the finding was written but not the substance of the finding, I think it is important for us to understand that. Would you mind if my staff followed up to find out those findings that you did not concur with, what the basis of that was to make sure that we are not overlooking the forest for the trees?

Lieutenant General BUNCH. I am happy to have that, ma'am.

Senator MCCASKILL. Thank you.

Let us talk just for a minute about B-2 modernization and transition to B-21. As you might imagine, I care a lot about the B-2. But I understand that time marches on and I want to ask a couple of questions. I know that there is funding in the fiscal year 2019 budget to continue the B-1 and B-2. I am under the impression—and I want you all to confirm this—that they will not be retired until there are a sufficient number of B-21s. Is that correct?

Lieutenant General HARRIS. Yes, ma'am. To say sufficient number, we intend to hold our bomber fleet at the minimum numbers that we have now and then grow as we add B-21s to the fleet to 175 total: 100 B-21s, 75-76 B-52s.

Senator MCCASKILL. I am assuming that both bomber wings that are equipped with B-1 and B-2 bombers will be re-equipped with B-21s?

Lieutenant General HARRIS. Right now, the approach, ma'am, is yes. If you are flying bombers today, you will be flying bombers in the future.

Senator MCCASKILL. Okay.

Our current bomber level is 158. We had 290 in 1991. Your written testimony says the current level is insufficient. As you just mentioned, your intent is to maintain 78 B-52s and keep going until 2050 and grow the B-21 to a minimum of 100. Is 178 sufficient?

Lieutenant General HARRIS. From a war plan perspective, 175 to 178 is better than what we have now. So there is improvement in that. We would like to fix the nine bomber squadrons we have to give them more airplanes per squadron and then continue to grow to somewhere in the neighborhood of about 14 to 16 bomber squadrons that are ready for the mission. So sufficient for the fight that we are looking at in the NDS. We would have to say yes. We would be more effective if we had more.

Senator MCCASKILL. Will we maintain bomber wings within the Air National Guard, and will they be equipped with B-21s?

Lieutenant General HARRIS. The National Guard will continue to be associated with the bomber wings that they are associated with now. That will not change with the B-21s.

Senator MCCASKILL. Is there a plan to phase out B-1s prior to B-2s, or will they be phased out at the same time?

Lieutenant General HARRIS. It is a balance, ma'am. The B-21 is going to be our penetrating bomber of the future. The B-2 is our most expensive bomber even though the numbers are small. The bomber road map from my understanding is going to start with initially B-1s phasing out. Once we have capability with the B-21, then we will look at the B-2 fleet and then move back to finish the B-1 fleet. So you will see both of them phasing out in the 2030s.

Senator McCASKILL. Okay.

Thank you, Mr. Chairman.

Senator COTTON. Thank you, Senator McCaskill.

General Harris, I have to say Senator McCaskill asked if the 178 bombers were sufficient, and you gave what seemed to be a diplomatic answer of no. Is that accurate?

Lieutenant General HARRIS. We say 175, I think is the number, is our minimum number. We are below that now, and I would be loathe to say in the future that that would be sufficient. But to match the NDS, growing to that number is an important task for us.

Senator COTTON. I heard the phrase "fight the NDAA [National Defense Authorization Act] fight".

Lieutenant General HARRIS. No. I am sorry. The NDS.

Senator COTTON. NDS, okay. You are saying we fight Russia and China, not the NDAA politics.

[Laughter.]

Senator COTTON. Thank you. I just wanted to clarify that because I understand you have to operate under constraints, but we can make decisions about what we think is vital to our national security in the long run.

Senator TILLIS?

Senator TILLIS. Thank you, Mr. Chairman.

Gentlemen, I was watching the testimony back in my office, and I believe, General Bunch, it was you who was talking about the KC-46 and some of the delays. Do you have any idea how that shifting to the right also affects the downstream deployment to bases, I believe Seymour Johnson being one of them?

Lieutenant General BUNCH. Sir, if we are delaying the acceptance of aircraft, it is going to have to have an impact until we start getting aircraft—

Senator TILLIS. It is pretty much day to day.

Lieutenant General BUNCH. We are going to look to see if we can accelerate maybe some. One of the things we have been approached on is can we accept more aircraft per month than what we have currently planned. We will have to look at the throughput of that. There are certain things we have to do. It may not be day for day, sir, but it is going to be a slip.

Senator TILLIS. You mentioned that the slippage is the contractor's inability to get the FAA certification. Do you all as a Department have insight into the bases for those delays to know if it is just—you would think they would be highly motivated to get through the certification, or if there are kinks over in the FAA, or do you even concern yourself with the root causes? You just expect them to produce an outcome.

Lieutenant General BUNCH. Sir, we expect them to produce an outcome, but we do get concerned when they are having issues.

They are continuing to go back and forth. They are having the dialogue. We have asked how they are addressing that and how aggressively they are working that with the FAA. We are concerned about that.

I do want to say that is not the only thing that is hindering us. I talked about some performance things, and also we are still having difficulties getting through some of the test program.

Senator TILLIS. General Harris, I did not keep the tick marks, but I was watching your testimony as well and then answers to some of the comments or questions from Senator McCaskill. And you used "minimum multiple times, as this at least satisfies our minimum requirement. In an open setting like this, can you tell us what sort of cumulative gap exists between us and our near peer competitors when all we do is achieve the minimum?

Lieutenant General HARRIS. Thank you, sir for the question.

Our industrial base, working with some of our advanced companies, keep us ahead of our competitors with a capability that they are yet to deliver from our adversaries. We are seeing their ability to project forces again: Russia, resurgent; China starting to work on that. All of our adversaries are wishing to have the capability we have.

The minimum numbers we are talking about is because we are having to focus on a balance. We did get a plus-up for 2019 with the budget that has been submitted, but it was not everything. We have to balance our nuclear, our space, and our conventional forces. That is why we are still working at the minimums.

But looking with the National Defense Strategy, not the NDAA, we are intending to be able to fight and win against any of our adversaries, whether it is today, it is in 5 years, or it is in 10 years.

Senator TILLIS. This actually may not be a question you all can answer in this setting, but can you give me a sense of some of our partners who are involved with manufacturing operations of the F-35, the Joint Strike Fighter? I know Turkey is one of them. For example, what is the extent of their involvement in that program?

Lieutenant General BUNCH. We can go into more detail. I do not have the full list, but the way that that program has been run, we have competitions. Turkey is a contributor of a significant amount of parts. They also have some repair facilities there for engines and other aspects that we deal with. We also have those in Italy. We have those with Japan, and we have others. Almost every international partner has certain components of the aircraft that are built in their areas.

Senator TILLIS. Okay.

In Seapower, we have this magic number of 355 for our fleet, the ship number. I, for one, think that it is nice to have some numbers so you can tick off when you are accomplishing things. But when we talk about numbers, we kind of get away from capabilities. As you are going from 20th Century to 21st Century data-centric, new strategies within the Air Force, what mistake do we make if we just come back and tick off the number of B-21s or F-35s or KC-46s versus that inherent capability you are looking for? In other words, are our adversaries strictly focused on hitting whatever their production targets are for comparable systems, or are they looking at things differently and being more dynamic in terms of

what they are fielding? I know in sea power, for example, Russia has a different maybe approach to how they are going to go about projecting power on the seas. How are we doing with that, and how are our adversaries looking at that, capabilities versus units?

Lieutenant General BUNCH. Senator Tillis, I cannot say exactly how our adversaries view it. What I can say is we are looking at ways that we can prototype and get more capabilities into the field in a more timely manner. Can I prototype and demonstrate a capability and not agree that I am going to buy 500 or 1,000? If it is better than what I have, can I go buy a certain number to get a capability out in the field to give more warfighting capability? That is an approach that Dr. Roper is bringing in and we have been trying to do to try to get more capabilities in the field, which kind of goes against here is a magic number I got to get to, what do I do to speed this up.

Lieutenant General HARRIS. Senator, if I can add. We are also looking at it from a network perspective. We would not compare one of our ships against one of their ships. You bring a fleet to that with our Navy. We bring a system with that from an airman's perspective. It is not just a single platform. It is what we can put together in air, space, and cyber. We continue to make advances in all three of those to make sure that we can dominate our adversary at a time of our choosing.

Senator COTTON. Senator Warren.

Senator WARREN. Thank you, Mr. Chairman.

Thank you to our witnesses for being here today.

Last year, the Air Force announced that it was considering retiring our fourth generation F-15 fighters. When I asked you all about this last year, the Air Force cited internal deliberations and said at that time no decision had been made. Where are we this year? General Bunch, General Harris? Who would like to answer that?

Lieutenant General HARRIS. Ma'am, I will start with that. The study is still ongoing, and we are looking at the F-35 that we are buying now and the beddown options that we can do. The National Defense Strategy is where we have been putting our focus for the last 6 months to a year, and now that it is published, it tells us to modernize what is most cost effective and capable for getting the mission done. That brings our F-15C and some of our assets back into the mix. There is nothing off the table. We are looking at, as we bring F-35s in, can we grow our capacity rather than just replace one for one. We are also looking to see if we cannot do that, what is our best asset, our least capable asset to retire based on the value that it would provide for us for the money—

Senator WARREN. Does that mean we are likely to have our F-15s, say, through the 2020s, or you just cannot say at this point still?

Lieutenant General HARRIS. Through 2020s, yes.

Senator WARREN. Through the 2020s, yes.

Lieutenant General HARRIS. If you are saying the next 2 years when we get into 2020. If you are saying for the next 12 years, the end of the 2020s, I do not know. We are looking at our F-16s, our A-10s, and our F-15s to make sure that we have the best capable Air Force from that, and the F-35, as a multi-role airplane, is very

capable of some of the things that the F-15C, the F-16, and the A-10 do.

Senator WARREN. I get that you all are still trying to work this out, and obviously, you are trying to maintain coverage at all times. I certainly understand that.

But the part I am struggling with is if we do not have a replacement in place, then what are we going to do? We are using these F-15s every single day, and it takes us to the question of this is an aircraft that has already exceeded 90 percent of its useful life. So the question I have, is there a variety of proposals for how it is we might extend the life of the platform? I want to know how it is that you are thinking about this. Are you thinking about extending it? What is the approach?

Lieutenant General BUNCH. Ma'am, I will address the extension and the acquisition parts of this.

Senator WARREN. Sure.

Lieutenant General BUNCH. On the first part, one of the things we are doing, we have got an EPAWSS [Eagle Passive Active Warning Survivability System]. That is a new defensive system that is going on the F-15E. We are continuing to do our testing on that for the F-15C such that if we make the decision to retain those platforms, that integration will be easier to do and we will have already done the tests and we can put it in the field in a more timely manner. We have not closed the door on that. That is something that we are doing to make sure we have that flexibility.

Senator WARREN. Do you have some kind of timeline on that decision? Can you just help me understand that better?

Lieutenant General BUNCH. I cannot tell you the timeline on the decision, ma'am. What I can tell you is one of the factors that we are looking at is those aircraft has been around for an extended period of time. There are service life extension programs that have gone in a lot of ways. We are doing some of the lower cost service life extension programs on that platform. Some of those become very expensive before very long to the point that it may not be cost effective to do a service life extension program for the cost that it would take to modernize that aircraft and continue to use forward. That is part of what is going into the analysis that we are doing to make sure we are making the best trade for the taxpayer dollar on the capability that we are trying to provide and balance that against can I get that mission done with the F-35s.

Senator WARREN. Then let me ask, there is an existing program of record to modernize the current F-15 fleet. For example, the Air Force previously planned to upgrade the active electronically scanned array, AESA, radar on the F-15s beginning in 2019. Is there funding in the 2019 request to do those upgrades?

Lieutenant General HARRIS. Again, ma'am, there is. We are focused primarily on the fleet we know we will keep in our F-15E. So EPAWSS Inc 1 and 2 is continuing to move forward with that.

Senator WARREN. You do have funding, though, in the 2019 because I thought you did not for that.

Lieutenant General HARRIS. For the F-15E fleet, yes, ma'am. If you are talking F-15Cs and our air defense, air superiority role, we do not at this time because we expect this year with the National Defense Strategy and I think it is a congressionally directed study

on our future fighter force that should align with our Air Combat Command's lead on the beddown of our fighters as we bring in F-35s—and you will also notice in the fiscal year 2019 an increase in our funding for our next generation air dominance. We are looking at the air superiority mission and what is the best way to do that. The near term may also include F-35s going to those F-15C units for that role.

Senator WARREN. Okay. I take it that means that you do not have a 5-year funding plan for upgrades to the F-15s. Is that right? Is that on hold while you deliberate about what to do next, or are you rolling that forward?

Lieutenant General HARRIS. I would say it is on hold at this time until we understand where it is going to go. If we decide that we are going to keep the F-15C, then we will go execute and keep it to be safe platform to accomplish the mission.

Senator WARREN. The reason I ask about this today is because the majority of the F-15 fleet is used for the Guard, and I just want to make sure the Guard does not get the short end of the stick on this one. You know, on 9/11, the F-15s, including from the 104th Fighter Wing in Massachusetts, were some of the first aircraft in the sky. These are our citizen airmen, and they have protected the Nation from the skies 24 hours a day, 365 days a year. I just do not see a scenario where they get retired anytime in the near future. If they are not going to be retired, then I think we owe it to those who are flying these planes that they have equipment and resources that they can depend on.

Lieutenant General BUNCH. Ma'am, I just want to say one thing. We are a total force. We are not going to ignore the Guard and Reserve. That is not part of what we are doing. Okay? I cannot tell you it is going to be F-15Cs. I am going to tell you that it is a total force. That is the only way that we can execute our mission.

Senator WARREN. I appreciate that and I am going to hold you to it.

Senator COTTON. Senator Cruz?

Senator CRUZ. Thank you, Mr. Chairman.

Gentlemen, thank you for being here. Thank you for your service.

The Air Force has reported a shortage of approximately 2,000 pilots, including a shortage of about 950 fighter pilots, which is essentially unchanged since last year. Much of the training occurs in Texas from Joint Base San Antonio, Randolph, and at Shepherd Air Force Base. I know they are working every day to resolve the issue.

Would you please update the committee on current efforts to address this critical problem?

Major General ROBINSON. Senator Cruz, thank you for that question.

Absolutely, the Air Force is laser-focused on that problem.

The update I would offer is we have narrowed the very focused study and analysis on root cause of the situation and how to fix it. We have narrowed it down to three main lines of effort. One, requirements. What are the total requirements for the pilot force from squadron all the way up to staffs?

Two, production. Do we have the production that we need in terms of producing pilots through the entire ecosystem, so initial

training and graduate level training all the way through to the military-ready pilot?

Then three, retention. We have the most control over the requirements in terms of influencing the decisions on that, very much fiscally informed control over production, but we have figured out that production is really the main effort. We have to set the production. Right now our current target is 1,400 pilots per year total force. We have to set it there and leave it there. That is part of the problem, the root cause of where we find ourselves in the position we are in now. We have changed the production over the last 10 to 12 years up and down, mostly tending downward.

The retention. We have a number of programs that are underway to influence retention to make our airmen want to stay and do this job. It is not just aviation bonuses, if you will. It is things like we have a talent management system that we call which essentially is way to give the member a bigger choice in their assignment selection and a voice where they would like to go for their next assignment, all the way through to things where they can volunteer for long tours overseas. We have cut over half of our 365-day tours overseas down to 6-month tours to, again, make that more enticing for them to want to stay and affect their quality of service, as well as their quality of life for their families. A number of efforts there. Other assignment options, second assignment in place policy changes to allow them to have more stability for their families, particularly for someone who has a professional spouse or very concerned about the quality of education that their children are getting with where they are.

Senator CRUZ. Of the different steps you mentioned, what are you seeing is having the most positive impact on retention?

Major General ROBINSON. Right now, the most positive impact that we are seeing are the things that are not necessarily monetarily related. It is these options for choice in how they would like to serve their country. We are also looking at a 4 to 6-month study that we are about to undertake with regard to a pilot-only or aviation-only technical track to see how that would actually pan out for the Air Force, and if we can achieve the proper outcomes, it is a win-win for the Service, as well as for the members.

Senator CRUZ. What else is needed from Congress in terms of authorities or otherwise to help address this problem?

Major General ROBINSON. Senator Cruz, right now we have gotten tremendous support from Congress up to this point. We appreciate that greatly.

The effort that we just finished at the direction of the Secretary of the Air Force, which was to get our fighter pilot crisis to a 95 percent manning level and then total pilot requirement up to 95 percent by the end of fiscal year 2023 is the goal she gave us. We are pursuing that quite heavily. As we work our way through the options that we are going to offer to our senior leadership, we may come to Congress for some assistance and policy changes and/or perhaps some legislative relief if we find an alternative way perhaps to do monetary pay versus aviation bonuses versus another way. We are looking at our coalition partners that have air forces like ours that are as capable and as advanced as ours, as well as

our joint partners, for how they handle those difficult challenges for those highly needed mission areas.

Senator CRUZ. Thank you.

General Bunch, let me shift topics. In the Department's budget request, it included \$2.3 billion for the development of the B-21 bomber. In fiscal year 2018, it was \$2 billion. Could you describe to this subcommittee what is planned to be done with that \$2.3 billion request?

Lieutenant General BUNCH. Sir, I will go into a lot detail given the nature of the work that we are doing there. What I will say is we are continuing the engineering, manufacturing, and development. We are continuing some of those risk reduction areas. What we are also doing is we finished preliminary design review. We are on our way to critical design review. We have manned up a good portion of what we need to do. We are making everything ready to begin our test program in the future, and we have delivered the first set of software for that platform and we are going through that. Then we are getting set up for the next set of software to come in. We are making good progress. I am comfortable today with where we are at in the progress that Northrup Grumman is making on the program.

Senator CRUZ. One final question, shifting to the F-35. Are you concerned about the cost of F-35 sustainment? If so, what efforts is the Air Force making to deal with that? What do you see of the consequences if that cost is not reduced?

Lieutenant General BUNCH. Sir, we are worried about the cost. The production costs are coming down along the lines that we predicted from the program office, that the production costs are coming down, the procurement cost of the assets. The sustainment costs have been higher than what we would like. We are working with the program office to look at what are the high time drivers of cost. What are the areas that we can attack? How can we work with Lockheed Martin? Can we stand up our depots faster? What do we do to get more people involved in the production of parts? How do we make that work? All of those are efforts that are ongoing.

The program office has a room where they have multiple charts to show what activities they are trying to do. We have small groups that have been stood up with all the Services and the acquisition executives of the services and Ms. Lord's staff that we are working on those and coming up with ideas. We have a full court press on that area.

We do need to drive those costs down. We need to get that to the point that it is not just cost effective to buy, it has to be cost effective to operate and maintain as well, sir.

Senator CRUZ. Thank you, General.

Senator COTTON. Senator Donnelly?

Senator DONNELLY. Thank you, Mr. Chairman.

Thank you all for your service to the country.

I want to return to an issue I have discussed with senior Air Force leadership before, the future of the 122nd Fighter Wing in Fort Wayne, Indiana. They have made it clear to me that the Air Force will maintain a manned air combat mission in Fort Wayne

and will continue to identify opportunities for mission conversion going forward.

As you noted in your written testimony, the Air Force has reinitiated the A-10 rewinging program to prevent further groundings and ensure a minimum of six combat formations remain in service until 2032. Unfortunately, these efforts will not entirely prevent some of your A-10 units from aircraft grounding due to wing issues while the wing box procurement program gets up to speed.

Fort Wayne's mission conversion to F-16s or F-35s would allow the divestment of its 16 A-10s with enhanced wing assemblies to other units in order to stabilize the A-10 fleet until the winging program catches up with the need. Not only that, if done promptly, the Air Force could take advantage of the unit's scheduled dwell time for conversion.

I understand that a site activation task force, or SATF, will be necessary to validate the 122nd's mission for an F-16 or F-35 conversion. When will you be able to begin these processes in keeping with the commitments that I have been given?

Lieutenant General HARRIS. Sir, unsure of when the process itself will begin, but the commitment that the Chief and Secretary have made to the unit about flying F-16s from the Burlington transition is still solid. We expect that to happen. What we intend to do—the pace of the A-10 rewinging will not keep up with stopping future groundings. There will be future groundings, but there will be enough aircraft available to fly the squadrons that we need for our combat operations and the capabilities. From that perspective, we will take the best of the A-10s that leave and push them around to other units to make sure they have flyable aircraft.

Senator DONNELLY. When will there be documentation that confirms an official conversion plan?

Lieutenant General HARRIS. As we complete our fighter force study—and part of that is tasked by Congress—I expect to have that out in fiscal year 2019, which will lay out our F-35 beddown plan and what we are doing with the rest of our fighter assets.

Senator DONNELLY. I am sure you know there is nothing standing in the way legislatively. Congress explicitly clarified in section 134 of the fiscal year 2017 NDAA, that the Air Force has authority to transition the 122nd to a new mission, F-16s or F-35s, stands regardless of whether the A-10 is retired.

Lieutenant General HARRIS. Yes, sir. We are aware of it.

Senator DONNELLY. The 2014 report of the National Commission on the Structure of the Air Force recommended expanding the number of Air Force associate units. In the coming years, as you make basing decisions on new platforms and shape the future force structure of the Air Force, do you foresee the Air Force expanding the number of associate units nationwide?

Lieutenant General HARRIS. We do, sir. There is a lot of advantage that we get from that expansion.

Senator DONNELLY. Actually my next question was going to be what advantages do the associate units offer you. So please.

Lieutenant General HARRIS. Sir, as we go through the retention that we talked about, it is a total force issue, and to be further clear, the pilot shortage we are having in the Air Force also impacts our Navy and Marine Corps teammates, but it is a national

problem. Our airlines are hiring 5,000 pilots a year, and when we get up to our max capacity, we as a DOD will probably only generate about 2,500 pilots a year. Even as we are improving and fixing our numbers, it is not going to be a national solution yet.

A lot of the experience that we are lacking right now—we fix much of our maintenance issues with bringing in 4,000 new maintainers over the last 12 to 15 months. But they are all young and they are not ready to maintain aircraft alone and they need supervision. A lot of that supervision resides in our Guard and Reserve with those experience levels. So bringing together more associate units will actually help us experience and provide the supervision we need to continue to have an effective and efficient force.

Senator DONNELLY. Thank you, Mr. Chairman.

Senator COTTON. Senator Peters, you are in the chute if you would like to. Otherwise we can give you a few minutes to collect your thoughts. I have more questions.

Senator PETERS. If you want to ask a quick question, that would be great.

Senator COTTON. I mean, we are ready for you to go if you are ready.

Senator PETERS. I can be ready quickly.

My main question I understand was already asked and answered, which dealt with A-10 rewinging. But I understand that that has already been dealt with, an important question for me in Michigan and Selfridge Air National Guard Base and the A-10 squadron that is there. I appreciated your response there.

I just have one question. The Air Force Research Lab (AFRL) has issued a 5-year phase I contract to develop and demonstrate a new cruise missile called the Gray Wolf. The missile includes network swarming behavior to counter integrated air defense threats and provides flexibility in highly contested environments.

I think frequently when people think of autonomous systems, they think of remotely piloted aircraft or drones, and when they think of autonomous weapons, they sometimes think of terminator robots. But a munition like a Gray Wolf could include both semi-autonomous capability operating in a swarm with collaborative algorithms and make the final decision about what to hit once a strike is launched at a target. I know part of the Gray Wolf program's goal is to ensure that munitions are cheap enough so that swarming will be cost effective.

I think this reflects a technological trend in warfare that the Air Force is certainly well positioned to take advantage of, but it will also require a shift in thinking as well. Low-cost swarms of munitions or platforms can be an effective response to the proliferation of anti-access/aerial denial systems.

But my question to you is could you please provide an update on the Gray Wolf, as well as discuss the potential for using network swarms, munitions, or platforms to defeat air defense threats. Basically where do you see that going?

Lieutenant General BUNCH. Sir, I will take the first hit and what I will do is say we will come and give you a more in-depth brief on the Gray Wolf program and what we are doing. I do not have those details with me today, so I apologize for that. But that is an area that we will come back.

Senator PETERS. I appreciate it.

Lieutenant General BUNCH. What I will say is we are looking at swarming technologies and autonomy. Those are areas that we are very focused on as to how we are working with the research laboratory, what can we demonstrate, how we would be able to implement those as maybe a lower cost solution to some of the problems. That is an area that we are looking at, we are working on, and we believe has great promise for something we can do in the future. But it is a mindset change that we have to work our way through.

Senator PETERS. Right.

Major General ROBINSON. Senator Peters, if I may add to that. Our Chief has us very, very focused on network aspects of warfare and thinking about that through disaggregated connectivity, multi-domain command and control and battle. The Chief always asks with every new platform that we get, that we attain, can it connect, can it share, most importantly, can it learn. That is where we are headed with regard to how we put the network and the systems of systems and employ them to be successful against those near peer and peer adversaries.

Senator PETERS. Right, great.

Yes, please.

Lieutenant General HARRIS. Sir, thank you for the opportunity to speak.

This is important to us. It is part of our air superiority 2030 system, family of systems. We recognize that it is not going to be only a high-cost penetrating capability that we need. We do need to have some standoff capability, others that penetrate, and a different thinking for those weapons. To that point, in the AI [artificial intelligence] effort, through AFRL in the next 5 years, we spend roughly \$1 billion, and we expect that to only increase to get after systems like this. So we are on that road.

Senator PETERS. Great. Appreciate that.

Lieutenant General BUNCH. We will come and give you specifics on that specific program. I just do not have those details, sir.

Senator PETERS. I appreciate that as well. Thank you for your answer.

Thank you, Mr. Chairman.

Senator COTTON. Thank you, Senator Peters.

The buzzer was a vote on the floor, which means Senator King and I will have about 10 minutes before we need to leave to a vote.

I want to touch on two issues we have not touched yet in this wide-ranging hearing.

First, remotely piloted vehicles. General Robinson, would you please provide the committee an update on the Air Force's RPA [remotely piloted aircraft] Get Well Plan?

Major General ROBINSON. Yes, Mr. Chairman. Thank you for that question.

Where we are right now in our Get Well plan for RPAs is we are essentially on track, and it is going very well.

One of our objectives was to establish a 10 to 1 crew-to-combat line ratio to make the tempo sustainable for the squadrons and what they do when they are deployed in place in a deployed-in-place mission. As well, we have the MQ-1 and MQ-9 formal training units up to 100 percent manning, which we did that by the first

quarter of fiscal year 2017. In fact, we actually exceeded that with regard to our combat crew ratio or crew-to-combat line ratio. We are actually at 11.3 to 1 in that regard.

Now we are taking that effort that we have done there to see what we can learn, lessons learned, and apply that to RQ-40 and RQ-170s going forward.

Senator COTTON. Second, the fiscal year 2017 NDAA directed the Air Force to transition a significant number of RPA pilots to enlisted personnel by the end of fiscal year 2020. What is the status of that transition, and do you expect to complete it in compliance with the fiscal year 2017 NDAA?

Major General ROBINSON. Yes, sir. If I may correct one comment I made. I said MQ-1/MQ-9. The MQ-1s are about done and retired. So now it is a focus on the MQ-9s.

But to your more current question, again we are on track there. We expect that we will achieve 100 regular Air Force enlisted pilots by September 2020. Right now, we have 11 enlisted pilots that are all flying operational missions that have completed training. We have 30 in this fiscal year's pipeline and 30 have been identified for fiscal year 2019's pipeline as well.

Senator COTTON. Thank you.

Senator King?

Senator KING. Since we do have to go and vote, I am going to run through some very quick thoughts and perhaps follow up with questions for the record.

I am interested in the JSTARS replacement, the Compass Call situation. The fundamental question is if survivability is an issue for the JSTARS, which I understand is one of the reasons the Air Force is thinking of canceling that RFP [request for proposal], are those issues not going to be consistent for Compass Call as well or for whatever replacement, or is that part of the idea of designing the replacement?

Lieutenant General HARRIS. Sir, there are similarities, but the mission is a bit different in the Compass Call where it is part of the kill chain that is in a different way than the JSTARS. Yes, some of the threat systems that can impact the JSTARS have some bearing on the Compass Call but because we are further ahead in that, where we are headed with the Compass Call recap and the transport of that over to basically a commercial platform is still in our best interest or from a JSTARS recap perspective, we feel it is better to get after this effort in a different domain with different capacity and capability by networking centers that are already in the airspace.

Senator KING. Is that technology mature? Are we ready to go with it, or is that going to generate a delay, the fact that we are going to new capabilities, new technologies?

Lieutenant General HARRIS. The technology is maturing as we go.

Senator KING. That worries me. That statement makes me nervous. I want mature technologies before we go.

Lieutenant General HARRIS. It is a three-increment process for our proposed plan in the fiscal year 2019 budget. We have a decision time, space in fiscal year 2023 that allows us, if we are behind with increments 2 and 3, that technology concern, it is a low risk

from our perspective at this time. But in 2023, if we decide that we are still behind in late delivering increment 2 or increment 3, we can extend our current 707 fleet additional years after to continue to provide that capability.

Senator KING. Let us move quickly to light attack aircraft, the OAX. I understand we are talking about developing a new aircraft. The funds are in the budget for further experimentation. We thought maybe we would be in a selection stage, but you feel that more work is necessary before you go in this direction?

Lieutenant General BUNCH. Sir, we made the decision that we did not need to do the combat demonstration because of the valuable data and enough of the information we got on some of the areas during the first phase of the experiment.

Senator KING. Will this new plane have capabilities that the A-10 does not? I have been sitting through hearings now for 5 years, and the Air Force seems to hate the A-10. Congress seems to like it. What are we gaining by discontinuing the A-10?

Lieutenant General BUNCH. Sir, this is not relative to discontinuing the A-10. This is additive capability for the United States Air Force. What we are trying to do is do a cost shift. What we are trying to do is buy something that is lower cost and lower to operate and allow us to pull our higher-cost-to-operate fourth and fifth generation platforms out of the permissive environment and do that in a more cost effective manner and still be able to get the mission done and allow our fourth and fifth generation aircraft to train for the high-end fight. It is not to replace the A-10. It is to provide a capability that we can put in a permissive environment and be able to execute the mission. It will allow us to—

Senator KING. A permissive environment is an environment without anti-aircraft. Is that what you are saying?

Lieutenant General BUNCH. To a certain level, sir. We would have some threats on the ground, a ground shoot from troops, those kind of things, some lower end surface-to-air, not much, but it is a more permissive environment which we could do many of the missions we do in today's environment. We could execute with a platform like that.

Senator KING. Are you satisfied with the progress you have made on developing this new vehicle, if you will?

Lieutenant General BUNCH. Sir, I am satisfied with where we are at. We need to do the next phase of the experiment so that we can get additional information relative to logistics and sustainment, and we are trying to put a network in.

Senator KING. I want to submit a question for the record about maintenance costs of the F-35. Secretary Wilson testified that that was a real problem, and I would like some more detail on that, what is being done to address that question.

Finally, General Robinson, Chairman Cotton and I had a fascinating meeting about 6 months ago with a group of your pilots. It was essentially a focus group. It was very interesting to us that it was not money that they were mostly interested in. It was they want to fly. They talked about establishing if you want to be a pilot, you can be a pilot. You do not have to go on a track to be a general officer or do other things. I hope that is something you are considering as you talk about this retention issue.

Major General ROBINSON. Yes, Ranking Member King. Basically from our Air Crew Crisis Task Force in the next 4 to 6 months, we are going to explore the possibilities for what we are calling an aviation technical track, so a fly-only track for our airmen. Then we have a report out to the Secretary of the Air Force—

Senator KING. If you have not done it already, I would urge you to do what we did, get a bunch of pilots in a room with somebody that knows how to facilitate a conversation and without you guys sitting in the room and listen and get a report on what they say. I thought—I think the chairman would agree—it was very informative. I hope that is something you might—

Major General ROBINSON. Yes, sir. We have done one of those about a year ago, and we continue to look at opportunities to do those again.

Senator KING. Thank you.

Thank you, Mr. Chairman.

Senator COTTON. It was informative, and I do think what Senator King says is a real option, similar to the Army's warrant program. I know people in the Army who resigned their commission after being a special forces team leader because they did not want to sit at a desk and plan for other special forces teams. They were given a chance to become a warrant officer and stay with the team. I do think it is an option. I know General Goldfein said that Lieutenant Goldfein probably would have taken that option, and that might not have been the best thing for the Air Force. Maybe General Robinson and Lieutenants Harris and Bunch would have taken those options as well, although your captains and majors informed us that they were the best pilots, much better than the colonels, for your information.

[Laughter.]

Senator COTTON. Gentlemen, thank you again for your testimony. It has been a very wide-ranging and informative hearing.

There will be questions for the record, as Senator King said, some others said. We will try to be prompt with those so you can be prompt with your answers as well.

This hearing is adjourned.

[Whereupon, at 4:40 p.m., the subcommittee adjourned.]

[Questions for the record with answers supplied follow:]

QUESTIONS SUBMITTED BY SENATOR JOHN MCCAIN

NATIONAL DEFENSE STRATEGY

1. Senator MCCAIN. Lieutenant General Bunch, Lieutenant General Harris, Major General Robinson, how does the President's budget request for Air Force aviation align with, and support, the National Defense Strategy and its emphasis on preparing for the high end fight? Please provide specific examples.

Lieutenant General Bunch, Lieutenant General Harris, Major General Robinson did not respond in time for printing. When received, answer will be retained in committee files.

DEPARTMENT OF DEFENSE BUDGET

2. Senator MCCAIN. Lieutenant General Bunch, Lieutenant General Harris, Major General Robinson, is the President's budget sufficient to meet the needs of the Air Force in terms of readiness and modernization?

Lieutenant General Bunch, Lieutenant General Harris, Major General Robinson did not respond in time for printing. When received, answer will be retained in committee files.

3. Senator MCCAIN. Lt. Gen Bunch, Lt. Gen Harris, Major General Robinson, what are the primary budgetary challenges you are facing in the wake of the recently agreed to 2-year budget deal?

Lieutenant General Bunch, Lieutenant General Harris, Major General Robinson did not respond in time for printing. When received, answer will be retained in committee files.

4. Senator MCCAIN. Lieutenant General Bunch, Lieutenant General Harris, Major General Robinson, the Defense budget request includes zero real growth in spending from fiscal years 2020 to 2023. Given the state of readiness and military capabilities today, how will Air Force aviation sufficiently rebuild to meet the requirements of the National Defense Strategy after fiscal year 2019, without additional funding?

Lieutenant General Bunch, Lieutenant General Harris, Major General Robinson did not respond in time for printing. When received, answer will be retained in committee files.

5. Senator MCCAIN. Lieutenant General Bunch, Lieutenant General Harris, Major General Robinson, if the Department is responsible for funding internal savings to help pay for additional capability and capacity, please provide specific examples of what those savings will be in the aviation accounts.

Lieutenant General Bunch, Lieutenant General Harris, Major General Robinson did not respond in time for printing. When received, answer will be retained in committee files.

INDUSTRIAL BASE

6. Senator MCCAIN. Lieutenant General Bunch, how would you describe the state of the industrial base that supports Air Force aviation programs?

Lieutenant General Bunch did not respond in time for printing. When received, answer will be retained in committee files.

7. Senator MCCAIN. Lieutenant General Bunch, what must this subcommittee be particularly mindful of related to the industrial base?

Lieutenant General Bunch did not respond in time for printing. When received, answer will be retained in committee files.

MULTIYEAR PROCUREMENT OR BLOCK BUY AUTHORITIES

8. Senator MCCAIN. Lieutenant General Bunch, are there programs that would benefit from cost reduction initiatives, such as multiyear procurement or block buys, that do not currently have these authorities?

Lieutenant General Bunch did not respond in time for printing. When received, answer will be retained in committee files.

PHYSIOLOGICAL EPISODES

9. Senator MCCAIN. Major General Robinson, please describe the Air Force's most recent efforts to mitigate physiological episodes.

Major General Robinson did not respond in time for printing. When received, answer will be retained in committee files.

10. Senator MCCAIN. Major General Robinson, is a limited number of vendors hindering equipment modification efforts?

Major General Robinson did not respond in time for printing. When received, answer will be retained in committee files.

11. Senator MCCAIN. Major General Robinson, can industry produce enough specialized components?

Major General Robinson did not respond in time for printing. When received, answer will be retained in committee files.

12. Senator MCCAIN. Lieutenant General Bunch, how much funding does the budget request include for addressing physiological episodes in Air Force aircraft? Please describe specific examples of items or efforts that are funded in the budget.

Lieutenant General Bunch did not respond in time for printing. When received, answer will be retained in committee files.

13. Senator MCCAIN. Major General Robinson, are T-6s back flying at their full envelope?

Major General Robinson did not respond in time for printing. When received, answer will be retained in committee files.

FIGHTER FORCE STRUCTURE CAPACITY

14. Senator MCCAIN. Major General Robinson, how many fighter aircraft does the Air Force currently have?

Major General Robinson did not respond in time for printing. When received, answer will be retained in committee files.

15. Senator MCCAIN. Major General Robinson, how many of those are combat coded?

Major General Robinson did not respond in time for printing. When received, answer will be retained in committee files.

16. Senator MCCAIN. Major General Robinson, the Fiscal Year 2016 National Defense Authorization Act (NDAA) required the Air Force to maintain a minimum of 1,900 fighter aircraft, of which at least 1,100 would be combat coded. In light of the National Defense Strategy, what is the number of fighters required?

Major General Robinson did not respond in time for printing. When received, answer will be retained in committee files.

17. Senator MCCAIN. Lieutenant General Harris, how is the Air Force assessing the optimal mix of fourth generation fighters, fifth generation, and next generation?

Lieutenant General Harris did not respond in time for printing. When received, answer will be retained in committee files.

18. Senator MCCAIN. Lieutenant General Harris, how has the National Defense Strategy affected this assessment?

Lieutenant General Harris did not respond in time for printing. When received, answer will be retained in committee files.

19. Senator MCCAIN. Lieutenant General Harris, has the Air Force budget request changed in response? How?

Lieutenant General Harris did not respond in time for printing. When received, answer will be retained in committee files.

20. Senator MCCAIN. Major General Robinson, the fiscal year 2019 budget retains 56 combat squadrons. Are those squadrons fully equipped and manned?

Major General Robinson did not respond in time for printing. When received, answer will be retained in committee files.

21. Senator MCCAIN. Major General Robinson, how is the Air Force balancing the desire to increase the number of squadrons versus fully equipping and manning the ones you currently have?

Major General Robinson did not respond in time for printing. When received, answer will be retained in committee files.

REMOTELY PILOTED ENTERPRISE

22. Senator MCCAIN. Major General Robinson, can you provide the committee an update on the Air Force's remotely piloted aircraft (RPA) "Get Well" plan?

Major General Robinson did not respond in time for printing. When received, answer will be retained in committee files.

23. Senator MCCAIN. Major General Robinson, the Fiscal Year 2017 NDAA directed the Air Force to transition a significant number of RPA pilots to enlisted personnel by the end of fiscal year 2020. What is the status of that transition and do you expect to complete it in compliance with the NDAA?

Major General Robinson did not respond in time for printing. When received, answer will be retained in committee files.

MODERNIZATION AND RECAPITALIZATION REQUIREMENT

24. Senator MCCAIN. Lieutenant General Harris, the Air Force is in the early stages of an extensive modernization and recapitalization effort with the F-35A, KC-46, B-21, T-X, VC-25B all requiring significant research and procurement dollars. Investment in the next generation air dominance capabilities have begun to ramp up significantly. Not to mention the recapitalization of the nuclear enterprise. How is the Air Force balancing all of these competing priorities?

Lieutenant General Harris did not respond in time for printing. When received, answer will be retained in committee files.

25. Senator MCCAIN. Lieutenant General Harris, how has the National Defense Strategy changed Air Force modernization and recapitalization priorities?

Lieutenant General Harris did not respond in time for printing. When received, answer will be retained in committee files.

26. Senator MCCAIN. Lieutenant General Harris, the Budget Control Act (BCA) remains the law of the land, so how is the Air Force approaching managing its modernization and recapitalization with the prospect of BCA funding levels beginning in fiscal year 2020?

Lieutenant General Harris did not respond in time for printing. When received, answer will be retained in committee files.

F-35 JOINT STRIKE FIGHTER

27. Senator MCCAIN. Lieutenant General Bunch, the new lot aircraft are performing better, but the overall readiness rates of the F-35 remain below expectations. While the program is facing a steep production ramp in the coming years, the sustainment enterprise is struggling to maintain and sustain the already fielded aircraft. Are you concerned about the affordability and effectiveness of the F-35 sustainment enterprise?

Lieutenant General Bunch did not respond in time for printing. When received, answer will be retained in committee files.

28. Senator MCCAIN. Lieutenant General Bunch, what efforts is the Air Force making to reduce the cost to sustain the F-35?

Lieutenant General Bunch did not respond in time for printing. When received, answer will be retained in committee files.

29. Senator MCCAIN. Lieutenant General Bunch, are you concerned that should the costs of sustainment not be lowered, it may force a reduction in the total number of aircraft the Air Force buys?

Lieutenant General Bunch did not respond in time for printing. When received, answer will be retained in committee files.

F-35 JOINT STRIKE FIGHTER OPERATIONS

30. Senator MCCAIN. Major General Robinson, please provide an update on F-35A deployed operations in both the U.S. Pacific Command (PACOM) and U.S. European Command (EUCOM) areas of responsibilities (AOR). What are the key challenges the Air Force has identified to operating and sustaining the F-35 forward?

Major General Robinson did not respond in time for printing. When received, answer will be retained in committee files.

F-35 FOLLOW-ON MODERNIZATION

31. Senator MCCAIN. Lieutenant General Bunch, the follow-on modernization for the F-35 is scheduled to bring key warfighting capabilities to the Air Force, but the schedule and budget remain in flux. Are you concerned about the affordability and executability of the Department's plan for Block 4 Continuous Capability Development and Delivery (C2D2)?

Lieutenant General Bunch did not respond in time for printing. When received, answer will be retained in committee files.

32. Senator MCCAIN. Lieutenant General Harris, the Joint Program Office is in the initial stages of its Continuous Capability Development and Delivery of Block 4 modernization upgrades. At the same time, the Air Force is beginning significant investment in next generation air dominance capabilities. In a world of limited dollars, how is the Air Force looking to balance between the two programs?

Lieutenant General Harris did not respond in time for printing. When received, answer will be retained in committee files.

F-35 PROGRAM MANAGEMENT

33. Senator MCCAIN. Lieutenant General Bunch, does the Joint Program Office management structure properly align responsibility and accountability?

Lieutenant General Bunch did not respond in time for printing. When received, answer will be retained in committee files.

34. Senator MCCAIN. Lieutenant General Bunch, what are your views on alternative management structures for the F-35 program, such as establishing separate service or variant program offices rather than maintaining a joint program office?

Lieutenant General Bunch did not respond in time for printing. When received, answer will be retained in committee files.

B-21

35. Senator MCCAIN. Lieutenant General Bunch, the Department's budget request included \$2.3 billion for development of the B-21 bomber. In fiscal year 2018, it was \$2.0 billion. Could you describe what is planned to be done with the \$2.3 billion request?

Lieutenant General Bunch did not respond in time for printing. When received, answer will be retained in committee files.

36. Senator MCCAIN. Lieutenant General Bunch, has the Air Force made any further reviews to determine if more information on the B-21 program can be released to the taxpayers who are funding this multi-billion program?

Lieutenant General Bunch did not respond in time for printing. When received, answer will be retained in committee files.

37. Senator MCCAIN. Lieutenant General Harris, on numerous occasions, Air Force leadership has stated the Air Force requires a minimum of 100 B-21 bombers. Has the National Defense Strategy altered the requirement for the B-21? Why or why not?

Lieutenant General Harris did not respond in time for printing. When received, answer will be retained in committee files.

KC-46

38. Senator MCCAIN. Lieutenant General Bunch, the KC-46 has endured numerous delays and unforeseen technical challenges. The latest Air Force estimate is first delivery of airplanes will not be until late in this year. How has the contractor been held accountable for the repeated delays?

Lieutenant General Bunch did not respond in time for printing. When received, answer will be retained in committee files.

39. Senator MCCAIN. Lt. Gen Bunch, what changes to required criteria for first aircraft delivery has the Air Force made in the last 2 years?

Lieutenant General Bunch did not respond in time for printing. When received, answer will be retained in committee files.

40. Senator MCCAIN. Lieutenant General Bunch, what are the next contracted dates that are in jeopardy?

Lieutenant General Bunch did not respond in time for printing. When received, answer will be retained in committee files.

41. Senator MCCAIN. Lieutenant General Bunch, does the Air Force intend on seeking consideration should those contract elements be breached?

Lieutenant General Bunch did not respond in time for printing. When received, answer will be retained in committee files.

42. Senator MCCAIN. Lieutenant General Harris, has the Air Force given consideration to pursuing an unmanned variant of the KC-46? Why or why not?

Lieutenant General Harris did not respond in time for printing. When received, answer will be retained in committee files.

43. Senator MCCAIN. Lieutenant General Harris, what would be some of the advantages and/or disadvantages of having an unmanned big wing air refueling tanker?

Lieutenant General Harris did not respond in time for printing. When received, answer will be retained in committee files.

44. Senator MCCAIN. Lieutenant General Harris, as part of its bomber roadmap the Air Force has committed to keeping the B-52 through 2040, while phasing out the B-2 and B-1 as the B-21 comes online in the mid to late 2020s. Please explain the rationale for keeping the B-52 while divesting the B-2 and B-1.

Lieutenant General Harris did not respond in time for printing. When received, answer will be retained in committee files.

45. Senator MCCAIN. Lieutenant General Harris, in light of the decision to keep the B-52 for the long term, does the Air Force have a long term modernization plan for the B-52 that takes a holistic view of the aircraft, given that the youngest B-52 is 56 years old today?

Lieutenant General Harris did not respond in time for printing. When received, answer will be retained in committee files.

46. Senator MCCAIN. Lieutenant General Bunch, the B-52H is certified to employ the JASSM-ER [Joint Air-to-Surface Standoff Missile]. The Long Range Anti-Ship Missile (LRASM) is based upon, and shares significant commonality with, the JASSM-ER. Are there any technical reasons why the LRASM could not be integrated onto the B-52H?

Lieutenant General Bunch did not respond in time for printing. When received, answer will be retained in committee files.

47. Senator MCCAIN. Lieutenant General Bunch, are there any other long-range, anti-ship missiles in the Air Force inventory?

Lieutenant General Bunch did not respond in time for printing. When received, answer will be retained in committee files.

48. Senator MCCAIN. Lieutenant General Bunch, after years of discussion, the Air Force has committed to re-engining the B-52H and begun to put funding into its budget. Can you please explain the Air Force's acquisition plan for re-engining, including estimated schedule and budget?

Lieutenant General Bunch did not respond in time for printing. When received, answer will be retained in committee files.

Airborne Battle Management

49. Senator MCCAIN. Lieutenant General Harris, the Air Force has opted to cancel its Joint Surveillance Target Attack Radar System (JSTARS) recapitalization plan, arguing that the proposed replacement is not survivable in the high-end fight. The Navy, on the other hand, is investing heavily in the E-2D Advanced Hawkeye and P-8 Poseidon, which both have similar vulnerability concerns as the proposed JSTARS recap program. Please explain the Air Force's approach to airborne battle management and how the Air Force and Navy intend to jointly execute airborne battle management in a high-end fight.

Lieutenant General Harris did not respond in time for printing. When received, answer will be retained in committee files.

JSTARS / ADVANCED BATTLE MANAGEMENT SYSTEM

50. Senator MCCAIN. Lieutenant General Harris, the Air Force has opted to cancel the JSTARS Recapitalization program and pursue an Advanced Battle Management System (ABMS). At the same time the legacy JSTARS aircraft are due to be divested in the early to mid 2020s, starting with 3 aircraft in fiscal year 2019. While the Air Force is proposing an incremental approach to fielding ABMS, much of the proposed plan remains aspirational. This committee remains concerned that the Air Force is divesting existing capability before its replacement is mature, let alone fielded. How is the Air Force managing the risk inherent in its fielding of ABMS, particularly in the mid-2020s to early 2030s, when there will no longer be legacy JSTARS to fill in should the Air Force's plan be delayed or deemed unfeasible?

Lieutenant General Harris did not respond in time for printing. When received, answer will be retained in committee files.

51. Senator MCCAIN. Lieutenant General Harris, the Air Force has argued that the JSTARS Recap would not be survivable in a highly contested environment. A key component of the Air Force's ABMS alternative is space-based. However, Air Force leadership, including General Goldfein and Secretary Wilson, have repeatedly stated that space is now a contested domain. This committee is concerned that the Air Force is simply moving capability from one contested domain to another. Can

you explain how moving capability from the air domain to the space domain increases survivability?

Lieutenant General Harris did not respond in time for printing. When received, answer will be retained in committee files.

52. Senator McCAIN. Lieutenant General Bunch, please provide an update on the current state of the JSTARS Recap competition. What happens while Congress deliberates on the Air Force request to cancel the program?

Lieutenant General Bunch did not respond in time for printing. When received, answer will be retained in committee files.

LOW COST ATTRITABLE AIRCRAFT TECHNOLOGY

53. Senator McCAIN. Lieutenant General Harris, The Air Force Research Laboratory is pursuing a program to introduce an unmanned aerial vehicle to support warfighters with a lower cost than traditional manned aircraft, while meeting capability requirements for support in contested environments. How is the Air Force thinking about the use of attritable unmanned air vehicles, and manned/unmanned teaming in general, in your concepts of operations?

Lieutenant General Harris did not respond in time for printing. When received, answer will be retained in committee files.

54. Senator McCAIN. Lieutenant General Bunch, what is the status and outlook for the Low Cost Attritable Aircraft Technology (LCAAT) program?

Lieutenant General Bunch did not respond in time for printing. When received, answer will be retained in committee files.

PILOT RETENTION

55. Senator McCAIN. Major General Robinson, the Air Force has reported a shortage of approximately 2,000 pilots, including a shortage of 950 fighter pilots, essentially unchanged since last year. Please update the committee on current efforts to address this critical problem.

Major General Robinson did not respond in time for printing. When received, answer will be retained in committee files.

56. Senator McCAIN. Major General Robinson, what efforts has the Air Force implemented that are seeing positive impacts on retention?

Major General Robinson did not respond in time for printing. When received, answer will be retained in committee files.

57. Senator McCAIN. Major General Robinson, what more is needed from Congress, in terms of authorities or otherwise?

Major General Robinson did not respond in time for printing. When received, answer will be retained in committee files.

AIRBORNE DATA LINK PLAN

58. Senator McCAIN. Lieutenant General Bunch and Lieutenant General Harris, Air Force leadership has talked about the importance of networks to their visions of the future of the Air Force. The committee is concerned that the Department of Defense's ideas for airborne data links have lacked vision and been disjointed. Please discuss your efforts in this area and how you are ensuring that the Air Force is interoperable, not only within its own elements, but with the Navy, Marine Corps, and Army as well.

Lieutenant General Bunch, Lieutenant General Harris did not respond in time for printing. When received, answer will be retained in committee files.

PRESIDENTIAL PROTECTION

59. Senator McCAIN. Major General Robinson, is the F-22 considered a high end asset by the Air Force?

Major General Robinson did not respond in time for printing. When received, answer will be retained in committee files.

60. Senator McCAIN. Major General Robinson, does flying Presidential protection missions increase readiness for the high-end fight?

Major General Robinson did not respond in time for printing. When received, answer will be retained in committee files.

61. Senator MCCAIN. Major General Robinson, in light of the National Defense Strategy's emphasis on focusing on training for a potential for a near-peer adversary, does it make sense for the limited number of F-22s to expend valuable flight hours and training time to the Presidential protection mission?

Major General Robinson did not respond in time for printing. When received, answer will be retained in committee files.

62. Senator MCCAIN. Brig. Gen. Robinson, what is the Air Force doing to ensure that our high-end assets are more focused on the high-end fight?

Major General Robinson did not respond in time for printing. When received, answer will be retained in committee files.

LIGHT ATTACK

63. Senator MCCAIN. Lieutenant General Bunch, the Air Force appears to be on the cusp of procuring a fleet of light attack aircraft to conduct operations against violent extremist organizations in a more fiscally sustainable way and to free up fighter aircraft to focus on training for the high-end fight. The Secretary of the Air Force has highlighted the light attack program as a new way of doing experimentation and acquisition fast. Yet, zero dollars were requested in the fiscal year 2019 budget request. Action does not seem to be meeting rhetoric when it comes to the pace of acquisition. What is preventing the Air Force from procuring light attack aircraft and their associated long lead material in fiscal year 2019?

Lieutenant General Bunch did not respond in time for printing. When received, answer will be retained in committee files.

AIR FORCE AIR-LAUNCHED MUNITIONS

64. Senator MCCAIN. Lieutenant General Harris and Lieutenant General Bunch, in your judgment, are your air-launched munitions inventories sufficient to support current operations and the Defense Strategic Guidance writ large?

Lieutenant General Bunch, Lieutenant General Harris did not respond in time for printing. When received, answer will be retained in committee files.

65. Senator MCCAIN. Lieutenant General Harris and Lieutenant General Bunch, are there individual air-launched munitions whose inventories, either present or projected, are insufficient to meet requirements? If so, what are they and what is being done to address the shortfalls?

Lieutenant General Bunch, Lieutenant General Harris did not respond in time for printing. When received, answer will be retained in committee files.

LONG RANGE ANTI-SHIP MISSILE

66. Senator MCCAIN. Lieutenant General Bunch, what is the long-term plan for acquisition of the Long Range Anti-Ship Missile?

Lieutenant General Bunch did not respond in time for printing. When received, answer will be retained in committee files.

67. Senator MCCAIN. Lieutenant General Harris, does the Air Force consider naval anti-surface warfare an important mission?

Lieutenant General Harris did not respond in time for printing. When received, answer will be retained in committee files.

68. Senator MCCAIN. Lieutenant General Harris, does the current LRASM program of record provide sufficient capability and capacity to support the NDS priority of China and Russia?

Lieutenant General Harris did not respond in time for printing. When received, answer will be retained in committee files.

ADVANCED WEAPONS

69. Senator MCCAIN. Lieutenant General Bunch and Lieutenant General Harris, what steps is the Air Force taking to ensure they have munitions that are relevant and effective against the increasingly difficult defenses our potential adversaries are

developing and fielding? Please provide specific examples, including research and development efforts.

Lieutenant General Bunch, Lieutenant General Harris did not respond in time for printing. When received, answer will be retained in committee files.

TRAINING INFRASTRUCTURE

70. Senator McCAIN. Lieutenant General Bunch, Lieutenant General Harris, Major General Robinson, as the Department focuses increasingly on the high end fight, how important are adequate training ranges and supporting equipment to ensuring our aviation forces are adequately prepared?

Lieutenant General Bunch, Lieutenant General Harris, Major General Robinson did not respond in time for printing. When received, answer will be retained in committee files.

71. Senator McCAIN. Lieutenant General Bunch, Lieutenant General Harris, Major General Robinson, are there areas where our training infrastructure needs to be improved, in terms of airspace, equipment or other elements? Please provide specific examples.

Lieutenant General Bunch, Lieutenant General Harris, Major General Robinson did not respond in time for printing. When received, answer will be retained in committee files.

72. Senator McCAIN. Lieutenant General Bunch, Lieutenant General Harris, Major General Robinson, please describe efforts the Air Force is making to increase and improve the use of live, virtual and constructive (LVC) training, and how those efforts are interoperable, within and among all the services.

Lieutenant General Bunch, Lieutenant General Harris, Major General Robinson did not respond in time for printing. When received, answer will be retained in committee files.

QUESTIONS SUBMITTED BY SENATOR TED CRUZ

NEXT GENERATION FIGHTER COMMUNICATIONS

73. Senator CRUZ. Lieutenant General Bunch, there is a great deal of information in the public domain concerning the Fifth Generation Fighters (F-22, F-35) inability to communicate and pass targeting data between each other in a denied environment. The Committee understands the Air Force has a roadmap to develop and field an advanced tactical data link in the 2030 timeframe. However, the need for a common solution for interoperability between Fifth-to-Fifth and more importantly, Fourth-to-Fifth Generation fighters is a clear demand signal from the combatant commands now.

In addition, the Air Force is pursuing constructs to achieve a multi domain command and control capability and has noted that “agile communications” is the foundational piece to achieve this goal. Over the past 5 years, several live-fly and joint demonstrations in operationally relevant environments have shown that technologies exist that are mature, effective, and programmatically feasible against current and future threats. Does the Air Force have the ability to pass threat and targeting data between Fifth Generation Fighters (F-22, F-35) and Fourth Generation Fighters (F-15, F-16, F/A-18) in a contested environment without being detected?

Lieutenant General Bunch did not respond in time for printing. When received, answer will be retained in committee files.

74. Senator CRUZ. Lieutenant General Bunch, does the Air Force currently have a requirement for a secure Low Probability of Intercept (LPI)/Low Probability of Detection (LPD) data link with Anti-Jam capabilities?

Lieutenant General Bunch did not respond in time for printing. When received, answer will be retained in committee files.

QUESTIONS SUBMITTED BY SENATOR BEN SASSE

LIGHT ATTACK AIRCRAFT (OA-X PROGRAM)

75. Senator SASSE. Lieutenant General Bunch, Lieutenant General Harris, the Air Force appears to be on the cusp of procuring a fleet of light attack aircraft (OA-X program) to conduct operations against violent extremist organizations in a more fiscally sustainable way and to free up fighter aircraft to focus on training for the high-end fight. The 2018 National Defense Strategy calls for a more resource-sustainable approach to low-intensity threats, and the OA-X program seems like a good fit for our National Defense Strategy. The Secretary of the Air Force has highlighted the Light Attack program as a new way of doing experimentation and acquisition fast. Surprisingly, the fiscal year 2019 budget request asks for zero dollars for the OA-X program. Action does not seem to be meeting rhetoric when it comes to the pace of acquisition. What is preventing the Air Force from procuring light attack aircraft and their associated long lead material in fiscal year 2019?

Lieutenant General Bunch, Lieutenant General Harris did not respond in time for printing. When received, answer will be retained in committee files.

