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INTRODUCTION AND STRATEGIC ENVIRONMENT

Chairman Courtney, Ranking Member Wittman, and distinguished members of the subcommittee, thank you for having us here today to provide testimony on U.S. Air Force modernization. Additionally, thank you for your leadership and dedication to rebuilding the United States military.

Our Nation faces a complex set of current and future security challenges that require we think and act differently and with urgency. The American homeland is no longer a sanctuary. Our citizens face threats from a variety of actors in both the physical and digital arenas. Competitors, especially China and Russia, continue aggressive efforts to negate our long-standing warfighting advantages while challenging America's interests and geopolitical position. China in particular is the nation's pacing threat. It has rapidly become more assertive, and is the only competitor potentially capable of combining its economic, diplomatic, military, and technological power to mount a sustained challenge to a stable and open international system.

The Chief of Staff of the Air Force has articulated what is at stake with his *Accelerate Change or Lose* white paper. It states "*unless we make significant changes to the Air Force's programmed force, we will not meet the pacing threat of China in 2030. Unless something changes, we will not be able to accomplish the Air Force's core mission's in the future operating environment.*" A growing body of evidence from adversary assessments, recent wargames, exercises, studies, reports, and other analysis underpins this assessment. Importantly, it is not just the Air Force that is reaching this conclusion. The House of Representatives Future of Defense Task Force recently issued an urgent call for change that is consistent with the Air Force's findings and assessment.

To make these changes will require difficult choices. It will require taking calculated risk now to reduce existential risk in the future. When considering the missions we perform today, in

the Middle East and elsewhere, it is fairly easy to calculate risk and recognize the changes that are needed. However, measuring risk becomes more challenging when we look into the future, at conflict scenarios with peer competitors like China; we must consider the risk that arises if we fail to recognize the need to change. The risk to our nation and the American way of life of losing in those scenarios far outweighs the calculated risks we are willing to take today to accelerate change.

The mission of the United States Air Force is to fly, fight, and win…Airpower anytime, anywhere. Military airpower is global, agile, flexible, rapid, and when necessary, highly destructive. *The USAF was created to realize the potential of military airpower to defend the United States, our citizens, and our friends.* We know that our potential adversaries respect—even fear—U.S. airpower, as they devote extreme amounts of money, time, and manpower to defend against it. We also know they are fielding capabilities to attack the United States and our friends through the air. In this, they hope to hold our territory, bases, and citizens hostage, making us vulnerable to coercion. Both of these conditions are not new…they existed after World War II and provided the impetus to create the Air Force in 1947. *In 2021, we must remember this "why" behind the Air Force as we look to the future.* We can make the changes necessary to sustain and strengthen the U.S. advantage in airpower, but to do so, we must concentrate on the core reasons we exist.

The U.S. Air Force has five core missions: air superiority, to operate unhindered in the air and deny it to the enemy; Intelligence Surveillance & Reconnaissance (ISR) from the air, which is essential to joint force operations; command and control, which provides the joint force with a common operating picture by connecting systems with the Advanced Battle Management System (ABMS); global strike, which is a primary concern of this subcommittee; and global mobility,

our ability to carry supplies and people and carry out logistics. These core missions represent what the Nation expects of the U.S. Air Force, and they are part of our heritage. But our continued ability to provide these core missions in defense of the nation is not guaranteed. For this to continue, the Air Force must change, because our environment is changing and our competitors are closing. For too long, we have mitigated short-term risk at the expense of long-term, and we must correct this imbalance.

Since the publication of the National Defense Strategy in 2018, the Air Force has worked tirelessly to identify new ways of approaching our toughest challenges in a peer fight, to include careful assessments of current and future risks. But our work is far from over. We look forward to continued engagement on the Air Force's future force design with this subcommittee and all of our stakeholders. It is the only way to ensure we are building a relevant ready force for the future. This year's budget request will be another step in that journey.

CURRENT CAPACITY AND CAPABILITY

Following the Interim National Security Strategic Guidance of the President, the National Defense Strategy and the National Security Strategy guidance, the Department of the Air Force seeks to invest in technologies and field systems that are both lethal and survivable against a peer threat. This ultimately means divestment of many outdated and less capable platforms in order to free up manpower as resources to field more capable systems and modernize. If we are to modernize to address the emerging threat, we must utilize resources tied to our legacy platforms and weapons systems that are decreasing in relevance today and will be irrelevant in the future; we must strike a balance between risk in the near-term and risk in the future.

Bomber / ICBM Force Structure

The future of our bomber force relies on the B-21 and a heavily modified B-52. Our budget proposal supports the Defense Department's principal priority to maintain a safe, secure, and effective nuclear deterrent that safeguards the homeland, assures allies, and deters adversaries. As you know, nuclear deterrence is the highest priority mission of the Department of Defense – our deterrent underwrites every U.S. military operation around the world and is the foundation and backstop of our national defense.

B-21

The B-21 Raider will form the backbone of our future bomber force. The B-21 will have the range, access and payload to penetrate the most highly contested threat environments to hold any target on the globe at risk. The B-21 will provide the capabilities to deter and, if needed, win in high-end, near-peer conflicts. Not only will the B-21 underscore our national security as the most flexible leg of the Nuclear Triad, it will also support Combatant Commanders across the range of military objectives as both a nuclear and conventional bomber. In under three years, the B-21 has transitioned from a digital design to two, physically manufactured test aircraft on the production line. The FY22 President's Budget ($2.87 billion) continues to fund the production of test aircraft and supports scaling the manufacturing infrastructure and capacity across the supply base. In addition, the budget also includes $108 million to procure initial long-lead parts in advance of low rate initial production.

In parallel, beddown preparations at Ellsworth Air Force Base (AFB), South Dakota remain on-track. The FY22 President's Budget requests $343 million to begin construction of six projects at Ellsworth AFB. The first B-21s are projected to arrive at Ellsworth AFB in the mid-2020s with base infrastructure ready to support. A second Environmental Impact Statement is

expected to begin in 2022 to assess the final two basing locations, Dyess AFB, Texas and Whiteman AFB, Missouri.

The FY21 NDAA required the Air Force to preserve minimum Primary Mission Aircraft Inventory levels with a path to a 225 bomber fleet. Our preferred end state is a two bomber fleet compromised of 225 modernized, relevant, and healthy B-21 and B-52 aircraft.

The Air Force is committed and on track to meet its key performance parameter of building B-21s with an average procurement unit cost of $550 million (Base Year 2010) / $639 million (Base Year 2019), assuming a minimum fleet of 100 aircraft.

B-52

While the last B-52 Stratofortress entered service in the U.S. Air Force in 1962, we expect to continue operating the B-52 through 2050. We will continue to invest in modernization programs to keep the platform operationally relevant. Major modernization efforts include the Commercial Engine Replacement Program (CERP), Radar Modernization Program, Combat Network Communications Technology (CONECT), and installation of Advanced Extremely High Frequency (AEHF) secured satellite communication capabilities.

The Air Force's number one priority for the B-52 is to ensure platform viability through 2050 and the CERP is critical to achieving this goal. CERP will replace legacy engines (TF33-PW-103) with new commercial engines using Middle Tier of Acquisition processes to remove more than three years from the traditional program schedule. Additionally, CERP is more complex than just a standard commercial engine refit. CERP includes new engines, flight systems, and cockpit throttle and displays. The Radar Modernization Program is also necessary to ensure viability through 2050 and will modernize the current Strategic Radar (AN/APQ-166), which is based on 1960s technology modified in the 1980s.

B-52 Combat Network Communications Technology (CONECT) fleet modification will be complete in FY23. This system provides an integrated communication and mission management system, as well as a machine-to-machine interface for conventional weapons retargeting. CONECT's digital infrastructure and architecture is the foundation for the 1760 Internal Weapons Bay Upgrade, which allows for internal carriage of J-series weapons through modification of the Common Strategic Rotary Launchers. This significantly increases the B-52's capability to store and deliver the Joint Direct Attack Munition (JDAM), Laser-JDAM, Joint Air-to-Surface Standoff Missile (JASSM) and its extended range variant, and the Miniature Air Launched Decoy (MALD) along with its jamming variant. Finally, the integration of the long-range standoff (LRSO) nuclear air-launched cruise missile and AEHF will ensure the continuation of the B-52's role in the airborne leg of the Nuclear Triad. The Air Force remains committed to B-52 modernization to ensure the Nation's oldest and most versatile frontline long range bomber remains relevant through 2050 and beyond.

B-1

The B-1 is a long-range, supersonic multirole bomber capable of flying intercontinental missions with the largest payload of guided and unguided weapons in the Air Force inventory. In FY21 we are retiring 17 B-1s as authorized in the FY21 NDAA. This will allow the Air Force to focus available resources on sustaining and modernizing the remaining combat-coded B-1s. The goal is to retire the most challenging aircraft to sustain in order to improve readiness of the remaining fleet. We will ensure the B-1s remain lethal and viable until B-21s are operational in sufficient numbers. The recently completed Integrated Battle Station upgrade enhances crew situational awareness and precision engagement capabilities and is the B-1's largest modernization effort ever. The first aircraft with this upgrade was delivered in January 2014 and

the last aircraft was completed in September 2020. Other efforts to update the B-1's communication systems are ongoing and ensures the B-1 remains the backbone of the Air Force's long-range bomber force until the B-21 arrives.

Lastly, the B-1 is the Air Force's threshold platform for the Long Range Anti-Ship Missile (LRASM). Integration of this weapon, coupled with the B-1's long range, high speed and large payload capacity, postures the B-1 for an important role in any conflict in the Indo-Pacific region.

B-2

The B-2 is the only long-range strike aircraft capable of penetrating and surviving advanced Integrated Air Defense Systems to deliver weapons against heavily defended targets. Its unique attributes of intercontinental range, precision strike, large conventional or nuclear payloads, ability to penetrate defenses, and low observable profile allow it to execute Nuclear Deterrence Operations, Nuclear Response, Global Strike, and Global Precision Attack missions. The Air Force will ensure the B-2 remains effective until the B-21 is operational.

Because delays in the Defensive Management System modernization effort would limit the operational utility of the system by the time it would be fielded, the Air Force has abandoned full Defensive Management System modernization. Instead, we are replacing the B-2's unsustainable cathode ray tube displays with modern sustainable displays.

The Air Force has completed development efforts to re-host the Stores Management Operational Flight Program software in the Flexible Strike program. This enables the B-2 to take advantage of advanced digital weapon interfaces, such as those used by the B61-12 nuclear weapon. The Flexible Strike capability reached Initial Operating Capability in November 2020 as part of the B-2 P6.2 block effort, which includes Military GPS User Equipment and B-2

hardware to support carrying the B61-12 weapon. The Air Force completed installation fleet wide, the Common Very-Low-Frequency / Low Frequency (VLF/LF) Receiver, providing the B-2 with a VLF/LF receiver for secure, survivable, strategic communications capability. Other on-going B-2 modernization programs include: Adaptive Communication Suite upgrades; enhancement of the Identification Friend or Foe (IFF) system; replacement of the Crash Survivable Memory Unit; integration of hardware upgrades for employment of the B61-12 nuclear weapon; and software upgrades to allow the B-2 to carry the extended range variant of the Joint Air-to-Surface Standoff Missile (JASSM-ER). Development of the Radar Aided Targeting System software upgrade began in October 2018 and will provide improved navigational handoff to weapons in a GPS-denied environment. Finally, the B-2 will continue sustainment efforts for the on-going Low Observable Signature and Supportability Modification effort, to improve aircraft maintainability and availability.

Intercontinental Ballistic Missile Modernization

Intercontinental Ballistic Missiles (ICBMs) are integral to U.S. nuclear deterrence. The Department of the Air Force is in the initial stages of replacing this 1970s-era ICBM capability with the Ground-Based Strategic Deterrent (GBSD). The GBSD is the most cost effective option for modernizing the ICBM leg of the Nuclear Triad and supports the National Defense Strategy to modernize the capability of nuclear forces. The GBSD will extend and improve the capabilities of the ground-based leg of the Nuclear Triad, providing a credible and responsive deterrent capability against current and emerging adversaries through 2075. The new weapon system will provide improved nuclear surety, safety, and effectiveness with enhanced security features as well as technologies that cannot be incorporated into the existing Minuteman-III system. Furthermore, attempting to keep the Minuteman-III through a Service Life Extension

Program (SLEP) is not a cost-effective option. GBSD will provide more efficient operations, maintenance, and security by modernizing critical infrastructure and decreasing lifecycle costs. The GBSD program remains on track in pursuing a low risk, technically mature design and is using innovative digital engineering and acquisition strategies to increase development speed and ensure on-time delivery. Deployment is scheduled to begin in the late-2020s in order to resolve capability, attrition, and age-out concerns with the current Minuteman-III weapon system, as well as meet warfighter requirements. The Nation is focusing investment on these new missiles, infrastructure, and their accompanying re-entry systems.

Tanker Fleet

Tankers are not only the lifeblood of our Joint force's ability to respond to crises and contingencies quickly, but are also essential to keeping our Air Force fueled as a global force. By the end of FY22, the tanker fleet will be comprised of 376 KC-135s, 36 KC-10s, and 71 KC-46s that execute rapid U.S. global operations. As of March 2021, we have accepted 44 KC-46 Pegasus aircraft and will receive a total of 179 KC-46s. As we divest the aging KC-10 fleet and right-size the KC-135 fleet, we continue to look towards the next generation for tanker recapitalization options.

KC-46

While we continue to sustain the current tanker capability, building the future tanker fleet remains one of the Air Force's top acquisition priorities. The KC-46 will deliver greater operational readiness, flexibility, and survivability to the Global Reach mission. The Air Force awarded Lot 6 on 13 January 2021 and Lot 7 on 20 January 2021, increasing the number of production aircraft on contract to 94. The Lot 8 contract for up to 15 aircraft is projected to award in the second quarter of FY22.

The first KC-46 aircraft was delivered to McConnell AFB, Kansas (Main Operating Base 1), on 25 January 2019. The Formal Training Unit at Altus AFB, Oklahoma, received its first KC-46 on 8 February 2019. The Air Force established Main Operating Base 2 at Pease Air National Guard Base, New Hampshire, on 8 August 2019, and Main Operating Base 3 at Seymour Johnson AFB, North Carolina, on 12 June 2020. Main Operating Base 4a at Joint Base McGuire-Dix-Lakehurst is planned to receive its first KC-46 in the first quarter of FY22. The Department of the Air Force will continue taking delivery of KC-46s at a rate of approximately 1.4 per month.

The Air Force remains committed to holding Boeing accountable to fix deficiencies identified in both developmental and operational test and evaluation of the KC-46's effectiveness, suitability, and mission capability. Partnered with Air Mobility Command, we have worked hard to accept the KC-46 while ensuring its major deficiencies—the Remote Vision System (RVS) and stiff air refueling boom—are properly addressed without undue burden on taxpayers or warfighters. On 2 April 2020, we came to an agreement with Boeing to fix the RVS deficiencies through significant upgrades, known as RVS 2.0, at no additional cost to the government. The air refueling boom engineering change proposal, initially awarded in August 2019, was definitized on 30 September 2020. The RVS design solution is expected by the end of FY23, and the stiff air refueling boom design solution is expected at the beginning of FY24. The retrofits and installs for both RVS and the boom across our fleet will begin in the first quarter of FY24. The Director, Operational Test and Evaluation (DOT&E) has stated Initial Operational Test and Evaluation (IOT&E) will conclude after the RVS and boom deficiencies are resolved; IOT&E is expected to complete in FY24. Additionally, we have delayed the full-rate production

decision until after IOT&E is complete and we are in receipt of the statutorily required Beyond Low Rate Production report from DOT&E.

Despite its current deficiencies, the KC-46 is safe to operate (adhering to flight manual cautions provided to our operators) and will be the Air Force's best tanker for contested environments due to enhanced situational awareness, battle management, and threat countermeasures. By accepting the KC-46 with known deficiencies, the Air Force was able to initiate familiarization and operational test activities while working with Boeing on long-term efforts to correct deficiencies. Accepting the KC-46, and fixing deficiencies in parallel with operational test and evaluation, is the fastest way to achieve full operational capability to meet warfighter requirements. Air Mobility Command plans is making the KC-46 available for limited operational taskings to alleviate pressure on legacy tanker fleets and allow some legacy tanker retirements.

The FY22 President's Budget requests $73.4 million in RDT&E funding for the ongoing KC-46 Engineering and Manufacturing Development and post production modification efforts, to include the boom telescope actuator redesign effort resolving the stiff boom deficiency. Additionally, the budget requests $2.4 billion in procurement funding to award Lot 8 (14 aircraft plus associated spares, engines, support equipment, and wing air refueling pods).

KC-10 and KC-135

The average age of our KC-135 and KC-10 tankers is 58 and 35 years old, respectively. Both fleets are challenged by aircraft parts obsolescence and diminishing manufacturing source issues. With the help of organic Air Force depots and industry, we are able to maintain these platforms as effective and safe weapon systems for the warfighter. We are executing several key

modernization, safety, and compliance initiatives to ensure our KC-135 fleet remains viable beyond 2040.

The FY22 President's Budget request will continue KC-135 modernization efforts including the Block 45 program, the Aero-I SATCOM program, and the Rudder Position Indicator program. To address supportability, reliability, and maintainability issues with legacy flight and engine instruments, the Block 45 program integrates a digital flight director, autopilot, radar altimeter, and electronic engine instrument display for our operators. The Aero-I SATCOM program allows the KC-135 to utilize Iridium SATCOM service, as the current Inmarsat service is planned to sunset in January 2023. Additionally, the Rudder Position Indicator program enhances safety of the KC-135 by providing the aircrew with situational awareness for the actual rudder position.

Additionally, the budget requests funding to keep our KC-10 fleet operational through its planned retirement, and includes funding for service bulletins and low cost modifications to ensure Federal Aviation Administration certification.

The Air Force took measured risk in FY22 tanker capacity in order to resource the capability we need for the future fight. As we look to better align the Air Force with the National Defense Strategy, KC-10 and KC-135 retirements were accelerated. In FY22, the Air Force is retiring 14 KC-10s and 18 KC-135s from the Active Duty fleets.

Presidential Airlift

VC-25B

The VC-25B program will replace the U.S. Air Force Presidential VC-25A fleet, which faces capability gaps, rising maintenance costs, and parts obsolescence as it ages beyond 30 years. The VC-25B program will deliver two new aircraft to meet the requirements for the President to

execute the roles of Head of State, Chief Executive, and Commander-in-Chief. Two Boeing 747-8 aircraft are being uniquely modified to provide the President, staff, and guests with safe and reliable air transportation and a level of communications capability and security equivalent to that which is available in the White House. Modifications to the 747-8 aircraft began in February 2020 in San Antonio, Texas, and include an electrical power upgrade, dual auxiliary power units that are usable in flight, mission communication systems, an executive interior, military avionics, a self-defense system, autonomous enplaning and deplaning, and autonomous baggage loading.

The FY22 President's Budget requests $681 million to continue Engineering and Manufacturing Development, aircraft modifications, and other product support activities.

Strategic and Tactical Airlift

C-5

The C-5 Super Galaxy provides all-weather worldwide strategic airlift for combat forces, equipment, and supplies, exemplifying Rapid Global Mobility as outlined in the National Defense Strategy. Current investment programs focus on fleet obsolescence, maintainability, and safety of flight.

The FY22 President's Budget requests $25.4 million in procurement funding, predominately for communications, navigation, surveillance/air traffic management (CNS/ATM) and C-5 core mission computer/weather radar (CMC/WxR) system equipment. CNS/ATM upgrades include Automatic Dependent Surveillance-Broadcast (ADS-B) Out modifications required for global airspace compliance. The CMC/WxR effort replaces an antiquated radar system with diminishing manufacturing sources and upgrades the core mission computer processor to meet the demands of future software modifications.

Additionally, the FY22 President's Budget requests RDT&E funding to support replacement of the Multifunctional Control and Displays (RMCD). This comprehensive sustainment modification mitigates the obsolescence of the current control and display units and increases capacity for future technology integration into the cockpit.

C-17

The C-17 is the only aircraft in the Air Force inventory that combines tactical capability with strategic range to operate from austere airfields. The fleet of 222 aircraft provides our Nation with unmatched flexibility to conduct theater and inter-theater direct delivery, airdrop, aeromedical, and special operations airlift missions. Agile and efficient software and hardware updates will ensure timely readiness, safety, and capability improvements as this premier airlift platform contributes to our national security objectives.

The FY22 President's Budget requests procurement funding to continue critical modifications to the C-17 fleet. This includes a filter fire mitigation for the On-Board Inert Gas Generating System, Large Aircraft Infrared Countermeasures defensive systems, and training system upgrades. The modification effort of a replacement heads-up display will address obsolescence of the current C-17 heads-up display and improve the system's availability, reliability, and maintainability. Additionally, FY22 RDT&E funding will address obsolescence and flight safety issues. The Beyond-Line-of-Sight communication system effort modernizes multi-channel voice and data communication subsystems to ensure the C-17 keeps pace with changes in Department of Defense communication infrastructure.

C-130H/J Fleet

The C-130 fleet consists of C-130H and newer C-130J aircraft, as well as special mission aircraft (AC/LC/EC/MC/HC/WC-130s). C-130Hs and C-130Js are medium-size transport

aircraft capable of completing a variety of tactical airlift operations across a broad range of missions. The fleet delivers air logistics support for all theater forces, including those involved in combat operations.

C-130H

The Air Force continues to modernize the C-130H fleet through a four-pronged approach emphasizing aircraft safety, airspace compliance, modernization, and partial recapitalization. Our C-130H Center Wing Box replacement program breathes new life into some of our hardest flown aircraft, enabling them to continue to safely operate well into the future. The C-130H Avionics Modernization Program (AMP) Increment 1 ensures the C-130H fleet is outfitted with modern communication equipment and complies with U.S. and international airspace transponder mandates. We completed the AMP Increment 1 installations for the C-130H fleet in April 2021. The AMP Increment 2 program improves the C-130H fleet maintainability and reliability by providing a new digital avionics suite, and mitigating obsolescence and diminishing manufacturing source challenges. The FY22 Budget requests $9.8 million in RDT&E and $29.8 million in procurement funding to support the C-130H fleet.

As with other weapon systems, the Air Force is taking acceptable risk in the C-130 portfolio as it focuses resources toward the future force. Specifically, in FY22 we plan to retire C-130H aircraft. Additionally, the Air Reserve Component (ARC) will be receiving five new C-130Js, resulting in a net reduction of eight aircraft.

C-130J

The Air Force has partially recapitalized the C-130H fleet with C-130Js, which also supports our Special Operations missions by providing Special Forces with extra weight carrying capacity, longer range, and better fuel efficiency. These special mission variants of the C-130J

conduct airborne psychological operations and offensive electronic warfare (EC-130J), weather reconnaissance (WC-130J), search and rescue (HC-130J), and special operations (MC-130J and AC-130J). The Air Force has multiple modification efforts for the C-130J, including Center Wing Box replacement, Large Aircraft Infrared Countermeasures, and an accelerated avionics upgrade to meet 2024 Federal Aviation Administration and international airspace mandates. The C-130J Block 8.1 modernization program, currently in production, delivers new communication and data link capabilities, a modern flight management system, and other key capabilities to the field. In addition, the Air Force plans to upgrade both our C-130H and C-130J fleets with a Mobile User Objective System and a Second Generation Anti-Jam Tactical Ultra High Frequency Radio satellite communication system to ensure we maintain key communication links anywhere in the world.

The FY22 President's Budget requests funding for C-130J RDT&E and C-130J procurement and modification efforts. The FY22 Budget also requests funding for HC/MC-130J RDT&E and HC/MC-130J procurement and modification efforts.

FUTURE CAPABILITY

Competing against rising peer adversaries during this time of unprecedented technology change requires a competitive acquisition system: one that is faster and more agile than our rivals. Consequently, the Air Force is transforming what we buy, how we buy, and who we buy from to retain the battlefield dominance we presently enjoy.

Understanding what to buy begins with a deep understanding of our potential adversaries and the anticipated future operating environment. We are using future force design that incorporates adversary assessments and lessons from wargaming and other analysis to drive warfighter requirements and our acquisition choices. We will continue to incorporate our

learning from these activities into future design iterations. This overall force design is being folded into our planning and programming in order to transition from the force we have to the force we need.

Faster Acquisitions

Fielding systems faster is step one. Through rapid prototyping authorities granted by Congress, like Middle Tier of Acquisition, we are trimming non-value-added steps that previously bogged down programs and slowed capability to warfighters. In May 2019, we achieved our "Century Challenge" goal of removing 100 years from program schedules and we've just kept going toward a new goal of 150 years. By the end of FY20, we identified 83.75 years of program accelerations for MTA programs and an additional 29 years of accelerations by tailoring our traditional acquisition programs. Rapid prototyping—"flying before you buy"—is not just a faster acquisition approach; it allows risks to be tackled earlier, before systems are in production when there is still time to troubleshoot. The benefit is proving out in our MTA programs, which maintain the same documentation and discipline as traditional programs.

The Department of the Air Force is embarking on an acquisition transformation by driving a "Digital Trinity" of initiatives into our acquisition enterprise. The Digital Trinity consists of Digital Engineering and Management, Agile Software Development, and Open Systems Architecture. These three initiatives will greatly reduce acquisition schedules, increase our access to innovative and emerging technology, reduce vendor lock, and allow us to field warfighting systems at the speed of relevance. Digital Engineering approaches will change the way we do business – shifting us from a document based enterprise to one based in models and data, allowing us analyze, assess, and make decisions regarding our system designs at machine enabled speeds. Agile Software Development enables us to deliver rapid, iterative improvements

to our software in an assured and secure manner. Finally, Open Systems Architecture will maximize flexibility in system design, improve access to commercial products and competition, and enable our weapon systems to be cheaply and quickly modernized and upgraded.

To successfully do this, the Department must establish a digital environment, or "tech stack," that is accessible across organizations and enables our workforce to access, understand, and modify the models of our weapon systems. We also must change the way we do business to not just require reports and documents based descriptions of our weapon systems, but rather all necessary data, models, software, and associated infrastructures to view, modify, and optimize a systems' lifecycle digitally. We also must apply smart coding and containerization to bring functionality from the labs to the field at a rapid pace.

The Air Force is pursuing these initiatives on several fronts. First, an Air Force Digital Campaign, with over 900 participants, is working on drafting best practices and training, developing acquisition tools and enablers, and crafting the steps forward. The Air Force has also issued acquisition guidance for each of the three elements of the Digital Trinity. We are actively deploying acquisition enablers such as containerization and code reuse platforms, open architectures embodied in mature Government Reference Architectures, and more.

Finally, and most importantly, we have a number of trailblazing programs that are actively employing these initiatives and experiencing great results. The T-7 program, our next training aircraft, is embracing model-based engineering and 3D design tools. In doing so, Boeing reduced assembly hours by 80% and cut software development time in half. The aircraft moved from computer screen to first flight in just 36 months. Our Ground Based Strategic Deterrent Program (GBSD) analyzed over 6 billion variant designs digitally prior to making a selection. GBSD's implementation of all elements of the Digital Trinity will enable faster design

cycles, ensuring the land-based element of our nuclear triad is a threat for many years to come. The A-10 Enhanced Wing Assemblies program demonstrates the value these principles bring to legacy platforms. Implementing digital engineering resulted in 236,500 operational hours returned to the A-10 fleet through individual aircraft maintenance assessments based on risk analysis methods pioneered by the organic A-10 government team. These tools have the ability to ensure airworthiness, safety, and affordability of the A-10 fleet into 2030 and beyond. We're excited about the potential of these new digital practices and look forward to reaping the benefits.

Smarter Acquisitions

As key innovation engine for the Department of the Air Force, AFWERX teams Airmen and Guardians talent with commercial technology developers to transition agile, affordable, and accelerated capabilities. Per May 2020 direction from the Vice Chief of Staff of the Air Force, AFWERX 1.0 was combined with AFVentures and Agility Prime. In this arrangement AFWERX was moved under the Air Force Materiel Command, where the Air Force Research Laboratory provides the "organize, train, and equip" functions for AFWERX, while strategic direction is provided by the Service Acquisition Executive. In December 2020, SpaceWERX became part of AFWERX, and in January 2021, the Small Business Innovation Research and Small Business Technology Transfer Center of Excellence also joined with AFWERX. Together AFWERX establishes technology, talent, and transition partnerships for competitive commercial advantage and military capability through the three lines of effort, AFVentures, Spark, and Prime.

"Air Force Ventures" or "AFVentures" is a key means of accelerating capability development by adjusting our work with startups, small businesses, and private investors. With

over eighty percent of our nation's research and development (R&D) now commercial—and our Defense Industrial Base continuing to shrink through mergers and acquisitions—transforming the way we work with commercial companies is imperative. In 2018, we began energizing our Small Business Innovation Research/Small Business Technology Transfer Program (SBIR/STTR) to lower barriers for commercial tech companies, speed contracts, and bring private investment into the Defense market. Since 2018, using our AFVentures process, we have awarded more than 2,000 contracts, with over 75% of the recipient small businesses being new to the Department of the Air Force. Those companies have gone on to raise $2.2 billion in follow-on private capital and win $1.4 billion non-SBIR government funding, resulting in a $5.6-to-$1 Return-on-Investment for the Department of the Air Force.

This Air Force Ventures process – one in which we open the door for innovative companies to propose ideas to the Department of the Air Force – showed strong value last year in being applied to non-Defense missions. Specifically, the AFVentures team was integrated into the Department of the Air Force Acquisition COVID-19 Task Force used to fight the COVID-19 pandemic, and asked to scale their operations to support FEMA, DHHS, and Joint priority missions. Over the course of 2020, the AFVentures process brought in over 3,700 pandemic-fighting ideas, 449 of which were identified to meet emerging COVID-19 related requirements – including PPE manufacture, digital contact tracing, remote telework, and more. The AFVentures evaluation approach, which can scale to evaluate hundreds of proposals in the matter of weeks, was implemented by the FEMA Emergency Response team, evaluating over 300 proposals and resulting in $645 million worth of awards. In all, the lessons learned from last year showed that the AFVentures process can be quickly implemented to solve emerging and urgent needs.

In an effort to scale the AFVentures success and accelerate transition of emerging technologies AFWERX has established Prime. The first Prime program is Agility Prime. Agility Prime is a non-traditional program seeking to operationalize commercial electric vertical takeoff and landing (eVTOL) vehicles (i.e., "flying cars") for military missions to accelerate the emerging commercial market. Agility Prime is the only all-electric passenger aircraft program in the U.S. Government. So far the program has awarded more than $100M of contracts with close collaboration between FAA, NASA, DOT, DOE, and HHS. Agility Prime use cases include: humanitarian response, disaster relief, firefighting, distributed logistics, personnel recovery, disaster response, ship to shore delivery, and medical evacuation. The Department of the Air Force has unique testing and safety resources-and military use cases-to help mitigate current commercial market and regulatory risks. Agility Prime has been using these resources, vice significant R&D funding, to attract investors, build confidence, and expedite commercialization, all while providing warfighters revolutionary flexibility with assessment across 13 different air mobility missions, some that will be tested in exercises beginning this year. Since releasing the Innovative Capabilities Opening in February 2020, 24 companies have applied. Two of those companies have made it through the Air Force airworthiness process, with several more following soon. This unlocks their opportunity to generate revenue for commercialization and to generate more data for accelerated learning, and civil and military certification. The program is designed to certify safety and airworthiness, procure systems for the most promising missions, and reach operational capability by FY23. Expanding our R&D enterprise from creator to catalyst is key for accelerating dual-use technology and countering the advantages of state-sponsored industrial bases. Based on the success of this model, AFWERX Prime announced Space Prime as the follow-on to "Agility Prime." Other potential Primes go across five sectors

to include commercial alternative energy, autonomy for mission and maneuver, digital engineering and advanced wargaming, supersonic travel, and microelectronics.

Foundational to the success of any of these AFWERX efforts is the amazing innovation network of Airmen and Guardians being empowered by Spark. AFWERX Spark has implemented fellowship programs to include the Defense Ventures Fellows, AFRL Fellows, and Academic fellows to rotate through AFWERX or private industry. Additionally, Spark empowers over 80 base-level Spark Cells to ensure close connectivity with current needs of our Airmen and Guardians.

Integrated and Adaptable Acquisitions

Our potential adversaries are modernizing and advancing individual systems while bringing families of systems (or systems of systems) together into an architecture to deny U.S. interests and counter potential U.S. action. To meet this threat we must not just field capable individual systems but also integrate our systems so they can work in unison to achieve the necessary operational effects on increasingly rapid timelines allowing us to fight at machine speeds. The Department of the Air Force must not only invest in war-winning capabilities but also invest in war-winning technology architectures. By way of analogy, it is no longer sufficient to have the right ingredients, but we must also have the best recipe.

To achieve this integrated approach, we continue to design, demonstrate, and evaluate a Department of the Air Force-wide integrated architecture under the auspices of our Department of the Air Force Chief Architect. This effort will require programs and platforms themselves to be built with agility via open systems and open standards so that they can adapt and upgrade components quickly in response to threats or opportunities to integrate technology as advances are made. We will also be engaged in a regular campaign of learning at the architecture level

with live demonstrations and evaluations of how we fight and where we fight. This is critical to moving from simply buying ingredients and hoping they form a coherent recipe, to a deliberate approach that impacts overall Air Force and Space Force architecture design, investments, technical requirements for future capabilities, and acquisition baseline updates for current systems.

An example of this impact of force level demonstration and evaluation occurred in February of this year during an Architecture Demonstration and Evaluation with U.S. European Command. This effort showed the importance of demonstrating and evaluating at the architecture level not only "how" the Department fights but also "where" it fights. By taking Architecture Demonstrations and Evaluations to the field, the Department has uncovered mission-critical gaps that could not have been uncovered merely at test ranges. This testing allows us to discover and fix the problems now rather than on the road to conflict when it would be too late to correct. We are committed to working with our Joint and Allied Partners so that existing systems can join easily. We ask Congress to support this capability so that future operators on the battlefield enjoy the same empowered capabilities they presently enjoy at home.

Connecting With the Joint Force

One effort that will stress how fast and smart our requirements, acquisition, and operations process can move is Joint All-Domain Command and Control (JADC2) powered by the Advanced Battle Management System (ABMS). Charged by the Secretary of Defense with leading the concept development for JADC2, the Department of the Air Force is building ABMS to create decision superiority by delivering relevant information and capabilities to warfighters and operators at all echelons. ABMS will integrate today's and tomorrow's sensors; develop applications embedded with artificial intelligence, sophisticated algorithms and multi-layered

protections to make sense of massive amounts of trusted data; link space capabilities with weapons systems and personnel across all domains; and design pods, platforms, pathways, procedures, and policies that connect and integrate the warfighter better and faster than in any time in our history.

On November 24, 2020, the Rapid Capabilities Office (RCO) was assigned as the Integrating Program Executive Office (PEO) for ABMS in a deliberate transition to start acquiring enduring capability through focused acquisition efforts and investments in digital infrastructure. Moving forward, the RCO will build on the Chief Architect Office (CAO) work from 2019-2020 which focused ABMS resources on technology maturation across product lines identified as "ONEs" and Onramp demonstration activities to prove the viability of the JADC2 operational construct. Upon transition to the DAF RCO, the product lines were replaced with a more streamlined acquisition framework and supporting personnel returned to originating Program Offices, lab directorates, or integrated product teams for continued maturation and proliferation.

The ABMS acquisition effort will pursue two interconnected investment paths: enduring digital infrastructure investments and Capability Release packages, which leverage those enduring investments, but focus on closing kill-chains and delivering immediate operational capability to the warfighter. RCO is working in conjunction with the acquisition community to ensure Air Force and Space Force systems have seamless interoperability and compatibility to meet the JADC2 operational requirements. The six ABMS capabilities required to connect the warfighter are secure processing, connectivity, data management, applications, sensor integration, and effects integration.

Driven by requirements approved by the Chief of Staff of the United States Air Force and the Chief of Space Operations, Capability Release #1 (CR #1) will focus on the Edge Network to enable sharing of information across 5th Generation Tactical Air and provide situational awareness to KC-46 and C2 nodes. Data from CR #1 will enable faster decision-making by the tactical, operational, and strategic customers.

Thank you again for the opportunity to testify before this Subcommittee. The dialogue we have today will help us design, build, and operate a force capable of fighting and winning now and in the future.