AIR FORCE FUTURE OPERATING CONCEPT

A VIEW OF THE AIR FORCE IN 2035

SEPTEMBER 2015

FOREWORD

Airmen and Airpower Advocates,

As America's Airmen, our purpose is to ensure the Air Force can always provide Global Vigilance—Global Reach—Global Power. We do this by providing Air Force forces to accomplish our five core missions. Since 1947, our core missions remain the backbone of our Service, and have evolved appropriately to address the changing environment. Every generation of Airmen has faced seemingly insurmountable challenges in accomplishing these missions, and yet, each generation of Airmen before us found a way to adapt. At crucial moments in time, they developed a way to succeed.

As we plan for the future, the rapid pace of change occurring throughout the world compounds the uncertainty and complexity of the future environment. If we are to continue to succeed in our purpose, we must consider both the challenges and the opportunities we will face in air, space, and cyberspace. We must ask ourselves, "How will future Air Force forces deliver responsive and effective Global Vigilance—Global Reach—Global Power in the anticipated environment of 2035?" To answer this question, we propose our Air Force Future Operating Concept.

The Air Force Future Operating Concept broadly portrays how the future Air Force will conduct its five core missions as part of a joint, interagency, or multinational force, or independently in support of national security objectives. The central idea is this: "In 2035, AF forces will leverage operational agility as a way to adapt swiftly to any situation or enemy action. Operational agility is the ability to rapidly generate —and shift among —multiple solutions for a given challenge." By using operational agility as a guiding principle in the conduct of our core missions, we can preserve the Air Force's ability to act quickly in response to any challenge.

Through application of this central idea, we describe our vision for how future Air Force forces may operate. The Air Force seeks bold and innovative approaches to its core missions, and success will also depend on close relationships with partners, particularly the members of the joint team. The ideas in this concept form a basis for examination, experimentation, and capability development planning for building the Air Force of the future.

We now face another of those crucial moments in time. The dynamic, complex future is already beginning to challenge us. It is time for this generation of Airmen to develop a way to succeed. We invite you to read about our concept and visualize how Air Force forces of the future may contribute to a strong National defense, support for our allies and partners, and a free and stable world for all.

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Secretary of the Air Force

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INTRODUCTION

Purpose

The Air Force Future Operating Concept is the Air Force's overarching force development concept. It describes how future Air Force (AF) forces will provide responsive and effective Global Vigilance—Global Reach—Global Power in light of the anticipated future strategic and operational environment. The AF Future Operating Concept broadly portrays how the future Air Force will conduct its five core missions as part of a joint, interagency, or multinational force, or independently in support of national security objectives. The primary audiences for this concept are Headquarters Air Force (HAF) and Major Command (MAJCOM) strategic planners.

Strategic Guidance

Relationship between the AF Future Operating Concept and Air Force Strategy Documents. The AF Future Operating Concept is guided by Service strategic direction expressed in *The World's Greatest Air Force—Powered by Airmen, Fueled by Innovation (A Vision for the United States Air Force)* (Jan 2013)*; Global Vigilance, Global Reach, Global Power for America* (Aug 2013); *and America's Air Force: A Call to the Future* (Jul 2014). *The Air Force Strategic Environment Assessment, 2014-2034* (AFSEA, 2014) provided strategic context to help frame the future operational environment.

The AF Future Operating Concept and the Strategic Master Plan (SMP) are complementary documents. The AF Future Operating Concept provides context for the direction in the SMP, while the SMP provides credible pathways toward the concept's projections. The AF Future Operating Concept takes the current core missions outlined in *Global Vigilance, Global Reach, Global Power for America*, and based on the future environment postulated by the AFSEA, describes how AF forces will evolve and conduct their core missions to help overcome national security challenges in that future environment. The AF Future Operating Concept provides a picture of future operations that informs Air Force Strategy by describing the desired future state for force development. As a force development concept, the AF Future Operating Concept is subject to testing, experimentation, evaluation and assessment to validate its ideas and/or suggest better alternatives.

America's Air Force: A Call to the Future and the SMP chart the institutional course to transition from the current state of AF forces to one similar to the future force described in the AF Future Operating Concept. *America's Air Force: A Call to the Future* uses strategic agility as a guiding principle for the Air Force as an institution that organizes, trains, equips, and provides operational AF forces in order to facilitate the transition. The imperatives and vectors flow through the SMP and the Annexes to outline the coherent actions that the institutional Air Force needs to perform to drive toward the target picture presented by the AF Future Operating Concept.

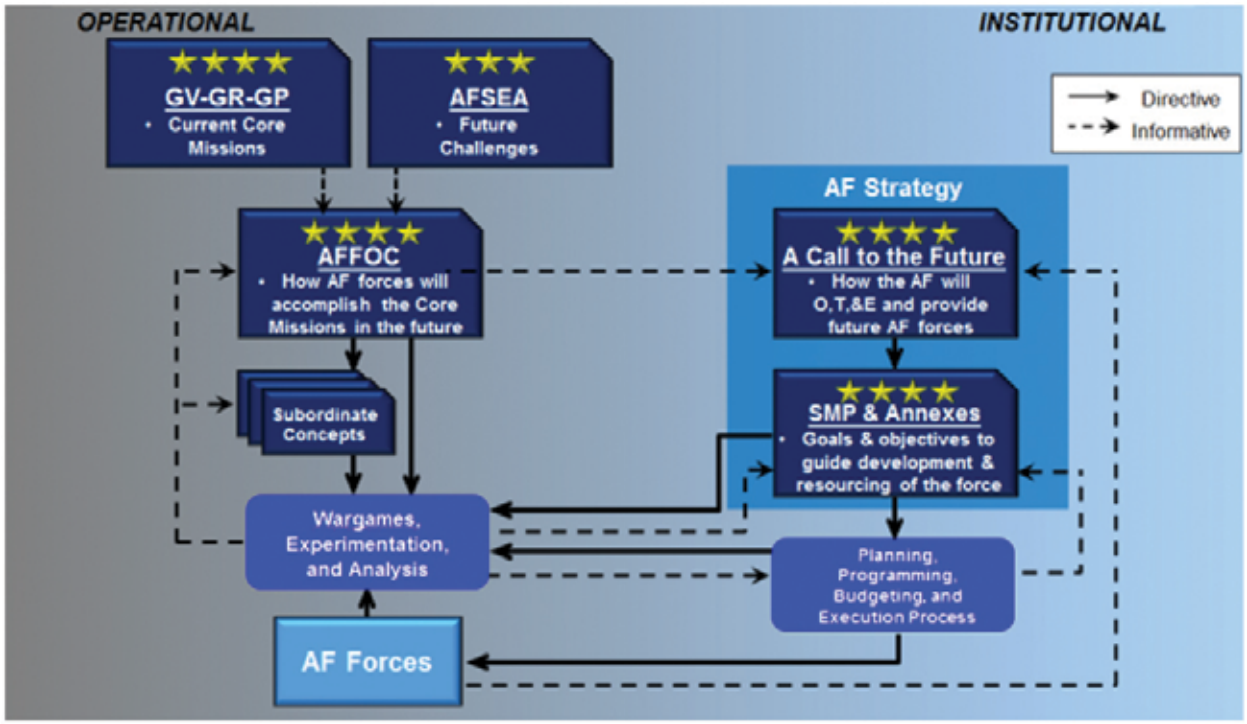

Figure 1:

Relationship between the AF Future Operating Concept and AF Strategy in the Strategy, Planning and Programming Process (SP3).

Strategic Context. While the AF Future Operating Concept portrays skilled Airmen employing advanced technology in innovative ways to deter and defeat adversaries, it also emphasizes that the nature of warfare will not change over the next two decades. War will remain a clash of wills between thinking adversaries, and it will occur in an environment of uncertainty and rapid change. However, the character of warfare is becoming far less predictable and more complex. No technology or technique will eliminate the metaphorical fog and friction of warfare, and no military advantage will go unchallenged by adversaries seeking to achieve their objectives and deny us ours. While war will remain an instrument of policy, with associated constraints/restraints and specified missions for military forces, navigating the relationship between policy and war will be even more challenging in the complex future.

The AFSEA, which compiles the expert analyses of the future environment across the Department of Defense, Intelligence Community, and think tanks, highlights that the era in which the United States can project power globally essentially uncontested has ended. It identifies four emerging trends that are highly likely to characterize the future: increasing speed and proliferation of technological change, geopolitical instability, increasing scarcity of natural resources, and an increasingly important and vulnerable global commons. The AFSEA uses these trends to derive six emerging trends with implications for the Air Force: 1) adversaries' acquisition and development of capabilities to challenge the U.S.; 2) increasing importance or frequency of irregular, urban, humanitarian, and intelligence operations; 3) increasing challenges to deterrence; 4) energy costs; 5) exploiting new technology opportunities; and 6) challenges of climate change.[1] The rapid pace of change occurring throughout the world acts as a common thread between these trends and implications, and compounds the uncertainty and complexity of the future environment.

1 *AFSEA, 2014-2034*, 19.

Accordingly, the AF Future Operating Concept's central idea of **operational agility** is the Air Force's approach to conducting its missions in future warfare. While the AF Future Operating Concept primarily describes AF forces implementing operational agility, Airmen fully understand that success will depend on close relationships with partners, particularly the members of the joint team. The Air Force seeks bold and innovative approaches to its core missions—either in a supported or supporting role—to achieve results that set the conditions for partner organizations and the joint force to succeed in support of national security objectives. The goal of this document is not to create a more effective future Air Force for its own sake, but for the sake of the joint fight and the Nation.

DoDD 5100.01, *Functions of the Department of Defense and Its Major Components,* (21 Dec 2010) directs the Air Force to "provide the Nation with global vigilance, global reach, and global power in the form of in-place, forward-based, and expeditionary forces possessing the capacity to deter aggression and violence by state, non-state, and individual actors to prevent conflict, and, should deterrence fail, prosecute the full range of military operations in support of U.S. national interests." *Global Vigilance, Global Reach, Global Power for America* (Aug 2013) amplifies this task by explaining how Airmen provide these three elements through the Air Force's five core missions. It defines the Air Force's core missions as: air and space superiority; intelligence, surveillance, and reconnaissance (ISR); rapid global mobility; global strike; and command and control (C2). *Global Vigilance, Global Reach, Global Power for America* describes how the Air Force provides air, space, and cyber power to the nation in the current environment; the AF Future Operating Concept describes how it will answer this call in the future.

The AF Future Operating Concept envisions a future in which information technologies permeate almost every object. Cyberspace will no longer be clearly separable from the physical domains, as actions in cyberspace will create effects in all other domains. The amount of human knowledge will have potentially increased by orders of magnitude, and technological advancement will empower individuals, groups and non-state actors to develop and employ capabilities previously reserved to nation-states. It will be impossible to achieve and maintain complete, permanent technological or informational advantages. Instead, advantages will be transient and belong to persons and organizations that display bold, adaptive, and innovative behaviors.

Accordingly, the military problem at the crux of the AF Future Operating Concept is:

How will future Air Force forces deliver responsive and effective Global Vigilance—Global Reach—Global Power in the anticipated environment of 2035?

The remainder of this document explains the Air Force's answer to this question and the desired future state.

Concept for Future Air Force Operations

The Central Idea: Operational Agility

Airmen, through their five core missions, have unique abilities to rapidly achieve Global Vigilance, Global Reach, and Global Power in support of national security objectives as part of a joint team. The increasingly dynamic environment of the future, however, dictates that the Air Force must change how it conducts these missions. In 2035, AF forces will leverage operational agility as a way to adapt swiftly to any situation or enemy action. **Operational agility** is the ability to rapidly generate—and shift among—multiple solutions for a given challenge. This agility will require Airmen to change the way they think about seizing and retaining the initiative in conflict. In the past, the Air Force has relied on speed and simultaneous operations to paralyze the enemy's decision-making process. The joint force of 2035 will instead place an adversary on the "horns of multiple dilemmas" by swiftly applying different strengths to produce multiple approaches, and the Air Force will contribute by creating combinations of air, space, and cyberspace capabilities to achieve desired effects in the battlespace.[2] The ability to cultivate and exploit an array of options will quickly enable AF forces to seize the initiative and overwhelm adversaries by generating too many approaches for an enemy to counter successfully. Operational agility will also change how Airmen consider resilience. The Air Force has focused on static hardening and survivability of exquisite platforms to assure resilience to operate in the face of enemy attacks. In 2035, the ability to rapidly produce and flex between multiple options will provide a dynamic form of resilience. Operational agility acts as a unifying principle that guides how the Air Force will conduct its core missions in the future.

Understanding Agility

In order to understand operational agility, it is helpful to deconstruct agility as an abstract idea. **Agility**, in a physical sense, is best defined as "a rapid whole body movement with change of velocity or direction in response to a stimulus."[3] This definition identifies the physical capability for quick movement and change, and it implies a mental capacity to quickly and continuously assess, decide, and act. Agility exists in terms of a reaction to a dynamic opponent, a moving target, or shifting conditions. At its heart, it is **the ability to act appropriately within a changing context.**

Agility depends upon several facets: flexibility, speed, coordination, balance, and strength. Alone, each is insufficient to create agility, but each plays a necessary role. One or more facets may figure more prominently in a given situation, but each will be present and work together to form the whole.

Flexibility describes the ability to move without restriction across a range of motion that is bounded by limits in distance and direction. Inadequate flexibility affects performance because it prevents a body from reaching its full potential and power. In essence, f**lexibility enables and represents the range of possibilities in agility**.

Speed refers to the swiftness of a movement or action in both physical and cognitive ways. Physical speed is required to quickly execute changes or adjustments to provide a timely reaction. Cognitive speed is necessary to ensure information processing and reaction times provide timely inputs that drive physical action. The two are interdependent. Quick actions without thought may not form the correct response to a situation, and thus will be ineffective. Likewise, quick recognition and decision without the ability to physically carry out an action in a timely manner is also ineffective. **Speed provides the responsiveness necessary in agility**.

2 The original "horns of a dilemma" term refers to Gen William Tecumseh Sherman's approach to present an adversary with more than one problem at a time, to baffle and confound him while retaining one's own alternatives and flexibility. B.H. Liddell Hart, *Sherman: Soldier, Realist, American* (Boston, MA: Da Capo Press, 1993), 315.

3 J.M. Sheppard and W.B. Young, "Agility Literature Review: Classifications, Training and Testing", *Journal of Sports Science* 24 (2006): 919-932.

Coordination signifies the combination of movements with both direction and force that result in intended actions. Physically, coordination comprises the movements of several physical parts sequentially or simultaneously combined into a coherent, efficient effort. Cognitively, it involves the integration of data related to the position and movement of physical parts, external and internal inputs, and the processes that plan, relay, and control physical actions. Essentially, **coordination smoothly integrates multiple parts and processes to create an intended action most effectively**.

Balance denotes the ability to maintain the center of gravity of a body within the base of support without losing control. Depending on the situation, a different distribution of weight or physical forces may be required to achieve balance initially. As the situation changes, the distribution may have to shift to maintain balance under new conditions. Balance is necessary in agility because **balance allows a body to be in the position to take the desired action**, for as long or as short a period as desired.

Strength represents the ability to exert force on a physical object. It is vital in agility because **strength embodies the physical capability to carry out the intended action**. Endurance, or strength sustained over a period of time, serves as an important aspect because it enables agility over a long duration. Flexibility, speed, coordination, and balance all play a role in creating the ability to act quickly in response to changing context, but strength is required to convert intent into action. Without strength, action is ineffective.

Applying Agility to Operations

The Air Force of 2035 must mature its ability to act quickly in response to dynamic adversaries within the changing future environment. An effective response to shifting stimuli requires the ability to change or adapt easily. There is a difference between committing wholesale to a select solution to a challenge versus committing to a philosophy that develops a variety of solutions that can be reconfigured or substituted quickly. An agile Air Force will possess a variety of options for a given challenge and, when the enemy develops a counter, will be able to adapt by flexing quickly to a different solution. The ability to rapidly generate multiple options or solutions for a given challenge will provide AF forces with the **agility** at the operational level of war necessary to engage adversaries effectively.[4] **Operational agility will preserve the Air Force's ability to act quickly in response to changing context.**

For AF forces to use operational agility to prevail in 2035, they will need to apply the facets of agility: flexibility, speed, coordination, balance, and strength. Each of the five facets has numerous applications in warfighting, from the individual tactical level through the national strategic level. The AF Future Operating Concept examines how these five facets apply to AF forces as a warfighting entity that functions as part of a joint team at the operational level of war.

Flexibility, the movement without restriction across a range of motion, applies at the operational level as the ability to flex across the range of options that the Air Force as an institution can provide. **Flexibility in operational agility manifests as Integrated Multi-Domain Operations.**

- **Integrated Multi-Domain Operations:** As a Service born of air-breathing platforms and doctrine, the Air Force has evolved to include space and cyberspace as key operating domains—but in many cases, Airmen of 2015 think of multi-domain operations largely as air operations that are supported or augmented by space or cyber capabilities. By 2035, the meaning of integrated multi-domain operations will encompass full interoperability among air, space, and cyberspace capabilities so that the combined effect is greater than the sum of the contributed parts without being limited by rigid interdependence. Modular air, space,

4 Joint Publication (JP) 3-0, *Joint Operations*, defines the operational level of war as "The level of war at which campaigns and major operations are planned, conducted, and sustained to achieve strategic objectives within theaters or other operational areas." See also JP 1-02, 8 November 2010 (as amended through 15 June 2015), 178.

surface and cyberspace forces and capabilities will be able to be separated, then connected, combined, or reconfigured. If the ability to act in one domain becomes limited, Air Force and joint forces will outpace the enemy by rapidly shifting to operations in other domains to accomplish the required tasks and objectives. Robust, resilient capabilities provided through cyberspace or space assets will reduce reliance on traditional air platforms to produce certain effects. Alternatively, kinetic or non-kinetic air operations will be directed at enabling or achieving space or cyberspace effects as well as attacking conventional targets. Of course, while the integration of the air, space, and cyber domains will be this document's primary focus, it is only when operations in these domains are effectively integrated with those in the land and maritime domains that the joint team will be able to reach its true potential. This recognition is central to the AF Future Operating Concept.

Speed has both physical and cognitive applications in operational agility, but at the operational level cognitive speed may be most important. Physical speed is provided by technology and capabilities. Cognitive speed, at the macro level, centers on an organization's methods to process information and develop decisions. **Speed in operational agility manifests as Superior Decision Speed.**

- **Superior Decision Speed:** Uncertainty and incomplete information are realities in warfare. Rather than demanding "perfect" intelligence, military forces must be able make accurate decisions at a rate that provides advantages over adversaries. In 2015, the Air Force has access to a wealth of data collected from a vast number of sources. However, it remains limited in its physical ability to process and integrate the sheer volume of data into actionable information in a timely manner. By 2035, the correlation of disparate bits of data will be even more critical to provide decision makers with the required information to make key decisions rapidly for operations. Collected data will be integrated in an open, adaptive information construct unburdened by unnecessary classification barriers. Air, space, and cyberspace ISR assets will share information seamlessly and contribute to a Common Operating Picture (COP). A global COP will require advanced capabilities and various degrees of automation to unlock the power of Big Data and correlate diverse pieces of information more quickly.[5] A User-Defined Operating Picture (UDOP) will provide the interface between the decision-maker and the global COP. Human-machine interfaces will be engineered to deliver the right information and level of detail to the right person at the right time to make the right decision. This construct will balance speed with accuracy to deliver the ability to make risk-appropriate actionable decisions. Together, these elements will increase the speed and quality of decision-making to allow superior responsiveness.

Coordination, the smooth integration of multiple elements to create an intended action, also has physical and cognitive applications in operational agility. The cognitive portion relates to awareness, tracking, and planning functions, while the physical portion deals with sequencing and controlling physical assets. All of these functions occur through command and control. **Coordination in operational agility manifests as Dynamic Command and Control.**

- **Dynamic Command and Control:** The Air Force's command and control mindset of 2015 focuses on large-scale, conventional air operations, augmented by space and cyberspace operations, with domain-specific tasking orders centered on an air tasking order (ATO). While today's Airman commands and controls in a faster and less-rigid way than in the past, this mindset will evolve further as domain-specific thinking matures into multi-domain integration. By 2035, enhanced battlespace awareness, improved planning and assessment, and organizational flexibility will better enable elements to self-synchronize and adapt to fulfill commander's intent. Commanders, planners, and operators will have the requisite authorities, at the appropriate levels, to integrate effects. Cognitively and physically, dynamic

5 The term "Big Data" describes large volumes of high velocity, complex, and variable data that require advanced techniques and technologies to enable the capture, conditioning, reliability, storage, distribution, management, and analysis of the information. Big Data helps make collection from all sources discoverable, and improves humans' ability to assess, explain, and anticipate adversary action while providing improved mechanisms for intelligence delivery.

command and control will permit fluid transitions between supported or supporting roles and between centralized control and distributed coordination. Operationally agile forces will defeat future enemy threats by fighting in a highly coordinated manner under the principle of *mission command*.[6] As with multi-domain operations, this approach must be developed within the framework of the joint and combined team. Dynamic command and control should exist across all components of a joint or combined task force, enabling any component to assume a supported or supporting role depending on the circumstances. Within a dynamic future environment, a shift in roles could exist for hours or months. The Air Force must have the structure and expertise built into its component headquarters to smoothly execute these transitions.

Balance requires a more theoretical application at the operational level of war. Essentially, balance consists of manipulating distributions so that an organization retains the ability to act. While it exists across several dimensions, the Air Force's ability to act centers on its capabilities. Concentrating capabilities into any single platform or role creates vulnerability and reduces the ability to be effective in other areas. The Air Force must maintain its ability to defeat a full spectrum of enemy actions without introducing singular vulnerabilities. **Balance in operational agility manifests as a Balanced Capabilities Mix.**

- **Balanced Capabilities Mix**: Operational agility relies on the ability to generate multiple solutions and options for any given challenge, but resources are not unlimited. Since the 1970's, the Air Force has used the term "high-low mix" to describe the intent to acquire a limited number of high-cost/high-capability platforms supplemented with many lower-cost/lower-capability platforms. By 2035, this simple characterization will have evolved into an Air Force that applies a balanced mix of air, space, and cyber forces across domains with an array of partners. The Air Force will use an appropriate subset of its capabilities—suited to the situation, mission and threat—and adapt as required. The future Air Force will retain tailored numbers of high-end assets to operate against adversaries that pose advanced threats to joint/multinational force efforts in any domain. To conduct follow-on sustained operations, or a sustained irregular warfare effort in a permissive or semi-permissive environment, AF forces primarily will use lower-cost/lower-capability assets, efficiently expending resources to achieve joint force commander (JFC) objectives while relying more on partner nations. Operations against adversaries with advanced capabilities will require unified action from the joint force and contributions from multinational partners to offset the fiscally-rationed capacity of the force. The Air Force's balanced capabilities mix of assets will foster the ability to engage with, train, and operate alongside partners with sophisticated systems as well as partners who possess lower-capability systems. Interoperability among air forces will provide opportunities for partners to contribute according to their strengths.

Strength, the physical capability to carry out an intended action, resides in operationally employable AF forces. To be effective in any response, these forces must be ready, equipped, and sustained. To be effective over the duration of the conflict, they must be resilient. The Air Force can augment these forces by teaming with advanced systems and joint, interagency, and multinational partners. **Strength in operational agility manifests as Performance-Optimized Teams.**

- **Performance-Optimized Teams:** In 2015, the Air Force uses legacy, Cold-War-era methods to describe the readiness and performance of units and personnel against static mission sets that are not necessarily correlated to current threats. By 2035, evolution in the way the service achieves readiness and required performance levels will change the organization, training and equipping of Airmen. As a result of the Air Force's prioritized focus on critical thinking, adaptive behavior, innovation, and collaboration skills, Airmen will

6 "Mission command – The conduct of military operations through decentralized execution based upon mission-type orders." JP 1-02, 158.

be more agile and effective in the battlespace. Their physical capability to carry out actions will be further enhanced by advanced technology, particularly in the field of Human-System Integration (HSI). HSI will bring high levels of combined human-system performance, trainability, maintainability, and survivability into technical designs, empowering humans to excel in tasks that they can do better than machines, while automated systems accomplish the tasks that they can do better than humans. The Air Force will integrate appropriate teams of manned and uninhabited systems[7] in air, space, and cyberspace to execute its five core missions. Each category of system will include varying degrees of automation to improve decision-making and performance, enhancing—not replacing—human cognition. Performance-optimized teams will also consist of partnerships with joint, coalition, and interagency members. Greater interoperability, transparency, and dynamic command and control will facilitate effective integration and teaming.

Employing Operational Agility

The Air Force of 2035 will harness the power of operational agility by leveraging flexibility, speed, coordination, balance, and strength at the operational level of war. AF forces will combine superior decision speed with dynamic command and control to plan and execute integrated multi-domain operations with a balanced mix of capabilities delivered by performance-optimized teams. The combination of these facets will enable operational agility for the future Air Force. However, operational agility is not an end state. It only serves as an approach to do something else—a way to achieve something greater. AF forces will be required to achieve Global Vigilance, Global Reach, and Global Power in support of national security objectives as part of a joint team in 2035. The Air Force will still execute its five core missions to meet this obligation. **Operational agility is the principle that guides how Airmen will conduct their core missions in the future.**

Core Missions in Future Air Force Operations

The five core missions of the United States Air Force have not changed fundamentally since the Service was established in 1947. President Harry S. Truman originally assigned these five interdependent and integrated core missions, which have endured as Airmen's contribution to the Nation's military portfolio. However, the way that Airmen perform these missions has evolved over time. Technological advances expanded the scope of these missions as Airmen, able to fly higher, farther, and faster, began to operate in air, space, and cyberspace on a global scale. *Global Vigilance, Global Reach, Global Power for America* details this evolution of the core missions from 1947 to present. However, evolution is not a singular event; it is a continuous process.

Threats and opportunities will continue to evolve from their present state as the world progresses toward 2035. The Air Force must continue to evolve as well. This approach also applies to how Airmen will perform the five core missions in 2035. Twenty years from now, when Airmen look to conduct operations, they will do so with truly integrated air, space, and cyberspace actions—and with a clear understanding of how these actions integrate into joint and combined operations. Freedom of action across these domains, whether constant or temporary, will be ensured by adaptive domain control in air, space, and cyberspace, and facilitated by command and control appropriate to this multi-domain environment. Global integrated ISR, mobility, and strike will incorporate new mindsets and methods to increase integration, access, and precision. Continued expansion into space and cyberspace will increase the magnitude of the Air Force's operating area. The Air Force of 2035 will continue to perform five core missions, but advanced technologies and approaches will extend their scope.

7 This document uses the term "uninhabited" to describe any vehicle, platform or system that does not physically contain a human within its essential form. It replaces the term "unmanned," which has become inadequate to describe the variable roles that Airmen play across the spectrum of remotely operated, semi-autonomous, and autonomous assets that the Air Force increasingly operates in air, space and cyberspace.

Figure 2. Evolution of the Air Force Core Missions		
1947	**Today**	**Future**
Air Superiority	Air & Space Superiority	Adaptive Domain Control
Air Reconnaissance	Global Integrated ISR	Global Integrated ISR
Airlift Mobility	Rapid Global Mobility	Rapid Global Mobility
Strategic Air Force	Global Strike	Global Precision Strike
Coordination of Air Defense	Command and Control	Multi-domain Command and Control

Airmen in Future Air Force Operations

New concepts may be technologically driven, but they are executed by Airmen. As the Air Force explores new ways to conduct its core missions in the future, it must do so with a clear-eyed understanding of what that future will require of its Airmen. These future concepts, at their core, rely upon Airmen who display critical thinking in complex situations, are educated and trained appropriately, and ultimately are empowered and trusted to execute.

The primacy of the trust relationship between leader and led is not new to the Air Force. Many parallels between the future and the early days of airpower exist. Early Airmen developed the concept of strategic airpower—an idea that promised an earlier end to war, with fewer casualties and a more lasting peace. However, the increased distance between commander and Airman, and the recognition that context at the point of execution would require creativity and initiative to get the most out of each sortie gave rise to the concept of *centralized control and decentralized execution.* This remains a central tenet of Airpower today, and it aligns closely with the joint concept of mission command. It is best realized when commanders give clear strategic guidance, and Airmen are entrusted to apply that guidance in a manner appropriate to the tactical situation as it unfolds.

As the Air Force peers into the future, the value of the trust relationship has never been greater. Technology has reduced the challenge of communicating effectively at range, but tempo and context will become the driving factors in future operations. The ubiquity of information, combined with Big Data analytics, complex algorithm development, and user-defined displays will provide Airmen at the point of execution with more specific, contextual, decision-quality knowledge than ever before. The opportunity to exploit a particular situation in the dynamic future battlespace may be fleeting; senior leaders who choose not to delegate decision-making to the appropriate level will find themselves outpaced by events while they attempt to gain sufficient situational awareness to direct action. Consistent with its history, trust will continue to be paramount in Air Force operations.

Whether the operation is nuclear deterrence, a humanitarian assistance effort, or another military operation, the Air Force will provide a solid foundation and a sustained commitment to the mission. This foundation is built by recruiting Airmen with indicated potential for critical thinking and adaptive behavior; screening for these attributes will require new metrics and forms of evaluation. Education and training to hone those skills must be at the heart of Airmen development. Trust is strengthened with confidence built by practice and consistency. The Air Force must train in a manner that assesses the Airman's ability to execute tasks successfully in dynamic situations, as well as the leader's ability to deliver clear strategic guidance appropriate for the same environment. Trust will empower Airmen—in both real and perceived ways—and it must be a touchstone if operations in the future are to succeed.

Transition to 2035

At its heart, this document is about change. It offers a glimpse of the Air Force of 2035, and illustrates how innovative, empowered Airmen will use operational agility to overcome challenges associated with uncertainty and complexity in executing their five core missions. The next five sections will examine each of the core missions to explain how these missions will have evolved, and depict future Airmen applying the facets of operational agility at the operational level of war as part of a joint team. Set in 2035, these sections do not attempt to forecast a precise or comprehensive future, but instead reflect the major transformations in how AF forces will operate.

The following core mission descriptions and vignettes portray 2035 in the present tense.

Air Force Core Missions - 2035

Multi-Domain Command and Control

The imperative to command and control personnel in the field is fundamental to military operations. Likewise, there is an enduring, ever-present need to tie ways and means to ends for desired effects, regardless of technology or context. Accordingly, the fundamentally linear approach codified in the legacy air tasking cycle—plan, task, execute, and assess—is indisputable. By 2035, what has changed is the technology and processes around which the Air Force organizes, trains, and equips forces to ensure the ability to conduct effective multi-domain operations. Airmen apply innovative approaches and technology to clarify and simplify C2 processes, thereby fostering shared understanding and mutual trust between commanders and subordinates.

At the operational level, Air Force C2 forces organize around the multi-domain operations center (MDOC), which provides the tools necessary to exercise *dynamic command and control*. The MDOC is the focal point for Air Force efforts to plan, task, execute, and assess missions as the Air Operations Center (AOC) did in the past. Serving as the air, space, and cyberspace operational headquarters, the MDOC contains the essential command elements and authorities to direct multi-domain operations. The permanent, infrastructure-heavy theater AOCs of 2015 have evolved into MDOCs that can quickly be repositioned, reconfigured, and augmented. Depending on the specifics of an operation, the designated primary MDOC may be located stateside, or it may be established in a regional location that maximizes its ability to perform C2. Many of the mission-specific functions of 2015's AOCs have merged or moved to geographically dispersed reach-back cells with globally networked capabilities. The AOC's divisions, benefitting from new technology and use of distributed operations, have reduced their forward-deployed footprints and reorganized into four functional teams: Strategic Design, Tasking, Operations Execution, and Rapid Assessment. Each team is operationally agile, balancing time, space, and force during planning and execution.

The MDOC provides the Air Force with the ability to plan, conduct, and assess *integrated multi-domain operations.* MDOC Airmen are trained to consider a full range of air, space, cyberspace and surface capabilities, effects, and limitations. They are bolstered by joint, interagency, and multinational partners where applicable. A fusion between specialists and generalists across the MDOC teams allows their members to create comprehensive effects, choosing the best domain or combination of domains to achieve desired results. Teams harmonize lines of effort that have variable timeframes and planning cycles, placing more emphasis on operational art and design than on targeting cycles. *Dynamic command and control* allows MDOC Airmen to fully integrate global assets with those already established in a region.

Advanced technology and innovative approaches change how the MDOC operates compared to the AOCs of the past. Functional teams build, execute, and assess operations based on a multi-domain COP. Individual force elements are tasked when they are available and required, in accordance with a continually updated plan that is communicated through the widespread use of UDOPs. UDOPs allow users at all levels to distill the COP's immense trove of information into comprehensible formats that suit their immediate needs.

18 JUL 2035
1847Z

A Gathering Storm

Colonel Lee, the MDOC Strategic Design Team chief, heard a distinct chirp emanating from his handheld. Picking it up, he saw notification of a secure transmission from Captain Jenkins in the Rapid Assessment Function Team. He quickly moved to a private location and biometrically verified his identity to access the message. What he saw made his eyes widen in realization.

From his daily COP intelligence update, Col Lee was well aware of a potential adversary's increasingly belligerent behavior, including threats to restrict navigation through an essential maritime line of communication (LOC). The National Security Council, monitoring the situation and growingly anxious for response options, was pressing SECDEF and Lee's combatant commander. "It rolls downhill," Lee thought, knowing it wouldn't be long before component commanders would be tasked to provide detailed support options, as well as potentially stand up a joint task force.

Capt Jenkins' message informed Col Lee that physical, cognitive, and behavioral analysis had detected subtle but unambiguous changes in the patterns of behavior of the country's military forces over the past 30 days. The changes correlated with actions that, if left unaddressed, would enable a swift move to restrict trade access and deny freedom of action to U.S. and multinational partner forces. "Time to earn my pay," Col Lee thought amusedly.

Col Lee was no stranger to strategic planning. From his early days as a lieutenant in the nuclear enterprise, he had cultivated an appreciation for the full spectrum of military force as an instrument of power. Advanced education in deterrence and strategic design, along with years of joint operational and staff experience, had prepared him for just such an occasion as this.

Col Lee immediately convened a joint strategy team consisting of members with regional experience, intelligence professionals, and experts in operational design and planning. The strategy suite's advanced communications and enhanced virtual reality capabilities enabled the physically disaggregated team to collaborate. The team began by determining what information they needed from the COP in order to build a UDOP that met their planning needs. The UDOP immediately began to synthesize historical and real-time data about adversary and friendly forces.

The team first designed alternative courses of action to deter adversary escalation through synchronized friendly force movements, actions, and messages. Fortunately, the adversary had shown no signs of nuclear brinkmanship. Col Lee was not surprised—America's ground-, air- and sea-based strategic deterrent, nested within an ironclad C2 network, made that a non-starter for them. Nevertheless, the adversary clearly believed it could achieve its aims through limited military action. "Do they think they can defeat us… or do they think we won't fight?" Col Lee mused. His team next developed options for multi-domain force application should deterrence fail, using intelligent processors to help evaluate potential outcomes in real-time. As commander's intent continued to develop, the team passed initial plans to the MDOC for refinement and potential execution.

The MDOC enables Airmen to transition away from the traditional 72-hour ATO cycle in favor of increasingly dynamic sourcing, tasking, and execution practices that operate inside adversary decision cycles. Interconnectedness, intelligent programming, and automation have tightened the feedback loop between planning, action and exploitation to produce *superior decision speed*. These advances, accompanied by commensurate authorities, reduce the efforts required by commanders to exercise force control, meaning they can concentrate more on command-level decisions while leaving tactical details to lower echelons. Ultimately, however, it is not technology but rather the rigorous training of Airmen that helps to balance span of control issues, resolve unwarranted fixation, and allow for the correct level of decentralized execution based on commander's guidance and strategic direction.[8]

8 This approach to C2 is reminiscent of John Boyd's theory of "organic command and control," which emphasizes the importance of human insight, vision, focus, direction, adaptability, and security over technological dependence. See Franz P. B. *Osinga, Science, Strategy and War: The Strategic Theory of John Boyd* (New York, NY: Routledge, 2007), 190.

29 AUG 2035
1301Z

Game Face: Air as the Supported Component

Maj Gen Trumpet, JTF-FREE TRADE Air Component Commander, rose to his feet as the display came into focus. He'd been expecting this call. It was Admiral Hall, the JTF Commander.

"Mike, I need you to pick up the supported role for this phase of the operation. This thing could kick off at any moment, and their anti-ship missiles, subs, and attack boats are keeping the strike group out of effective range. I just got off the line with Admiral Carnes and she is standing by to support your effort to knock these guys out of the LOC."

"We've got it, Sir. I'll issue guidance to my Strategic Design shop. The MDOC is fully outfitted and prepared to take on this role. My team has already developed options, and we'll have a recommended course of action by 1900. Big picture: we are planning to take down threats to our space fleet, paralyze them in cyberspace, and neutralize air and missile threats to the strike group. Then we'll concentrate on the surface forces. The sub hunt will be a team effort. We'll need something from every component to make this all happen, but I have no doubt we can get it done."

"Copy all, Mike. Be prepared to switch to a supporting role for follow-on operations once you've cleared a path. Talk to you soon."

As the display faded, Maj Gen Trumpet lowered his gaze to his UDOP, which showed him a macro view of the AOR with key friendly and adversary features highlighted. Years of training and education, scores of joint combined exercises, and multiple strategic planning jobs had prepared him for this moment—and he knew his Airmen were up to the challenge. The first step in his approach would be to ask Admiral Carnes to maneuver the advance echelon of the strike group in a feint that would further expose the enemy's order of battle….

The fully interconnected MDOC has shifted away from a view of hardware-based computers as "the system" in favor of *performance-optimized teams* that integrate advanced human-system interfaces with an algorithm-driven network. Unlike the transactional computer interactions that occurred in 2015, decision makers in these operations centers benefit from relationship-based interactions between humans and machines. This relationship combines computers' ability to solve complicated problems and complete repetitive or specialized tasks in ordered environments with human operators' ability to manage complex, novel issues. The multi-domain COP connects distributed users and informs humans of the validity and completeness of data much in the way validation services have done for GPS-enabled devices for decades. Armed with data-error probability information, Airmen in the MDOC rapidly adapt operations to changing situations. The fog and friction of war persist, but optimal human-system interfaces help planners and operators rapidly detect gaps in understanding and promptly overcome impediments to mission accomplishment. The system is resilient and self-healing in the face of enemy attacks on communication and information assurance, able to withstand breaks in connectivity while still allowing users to collaborate with other connected operators to maintain localized situational awareness. The network balances the respective strengths of both forward-deployed forces and rear-based nodes.

New technologies and methods have necessitated a paradigm shift in the way the Air Force trains and assigns personnel for C2 operations. Traditional tactical specialists continue to contribute to

operational C2; however, specially trained multi-domain C2 Airmen now lead operational design and execution efforts. Together, they form a talent-based *balanced capabilities mix*. Multi-domain C2 Airmen begin their careers specializing in one of the domains, achieving tactical depth and experience, then apply to join the C2 career field where they will receive broadening education in operational art and prepare to manage and control operational-level activities. Airmen are selected for the multi-domain C2 career field based on their cognitive abilities, adaptability, and networking skills. Multi-domain C2 Airmen are expected to work in small teams with increased individual responsibilities. They must maintain disciplined focus to handle frequent shifts between virtual preparation and real-world missions, as operations are rapidly modeled and simulated to determine optimal approaches, sometimes minutes before execution. As multi-domain C2 Airmen develop their skills and experience, they mature into trusted operational and strategic leaders for the Air Force of 2035 and beyond.

17 SEP 2035
1920Z

The Multi-Domain Operations Center

Two weeks ago, friendly efforts to deter escalation failed as the adversary, declining invitations to engage peacefully, instead initiated deliberate attacks against commercial assets in space and cyberspace while staging air, maritime, and land forces for an immediate takeover of the LOC. As a result, JTF-FREE TRADE commenced Phase II operations to seize the initiative swiftly, defeat adversary forces, and reopen the LOC under enduring conditions.

Looking across the MDOC execution floor, Major Montoya surveyed the disciplined but electric activity as Airmen and joint partners simultaneously executed integrated air, space and cyberspace operations in support of JTF-FREE TRADE. She had been on shift duty seven days a week for the past two months as one of five Operations Execution Function Team leads. Her job was to lead an integrated air, space, and cyberspace line of effort to orchestrate time-sensitive strike missions. At that instant, her four counterparts were busy working complementary lines of effort generated by the Strategic Design Team to complicate the enemy's decision calculus.

In a previous assignment as a logistician, her commander had recognized Maj Montoya's ability to analyze complex problems quickly and critically. He had recommended she apply for the Multi-Domain C2 career field to gain exposure to operational planning. Now her training was paying off. Despite being in the new job for only a year, rigorous exercises had prepared her to work smoothly with the other function teams.

Those skills had come in handy the day prior, when she had provided critical support to a long-range strike mission that had launched from CONUS to eliminate a forward enemy outpost on a remote island. When emerging intelligence revealed the probable presence of noncombatants in the target area, Major Montoya had coordinated a team of air, space, and cyberspace operators to reassess the targeting plan and warn the aircrew about the changed conditions, pushing updates to the bombers' UDOPs en route. The airborne mission commander, alerted to the new situation, had confirmed the presence of noncombatants near two of the targets and aborted that portion of the attack. The strike had been only partially curtailed, and they weren't all over the global news.

Maj Montoya's MDOC was definitely not like the AOC her father had described. The MDOC was fully integrated and highly responsive to changing conditions. Humans and computers worked together to develop COAs, run simulations, and direct operations. Airmen still made the decisions and refined the plans, but they were no longer fighting system limitations to accomplish their objectives. Upon her redeployment, she planned to qualify for Strategic Design duty. She was constantly impressed with how Col Lee's team could leverage the COP, expert advice, and practiced insight to create lines of effort that integrated effects across domains. However, that opportunity would have to wait—the operations team needed her leadership right here and now.

Multi-domain C2 is not an end in itself. The MDOC is also a joint integrator and enabler, able to lead or support operations as situations dictate. It is flexible enough to work in both ordered and disordered environments, to adapt to the dynamic needs of a developing regional problem, or to handle the highly regimented C2 requirements of nuclear operations. Through the MDOC and its enabling technologies, the Air Force provides C2 across the full spectrum of conflict. *Dynamic command and control* empowers MDOC Airmen to integrate the operations of a variety of assets, from aircraft, to satellites, to networks, to ground formations, to directed energy assets. Revolutionized battle management command, control and communication (BMC3) of air, space and cyberspace operations enables prompt, effective multi-domain coordination of effects.

Adaptive Domain Control

Air Force forces continue to operate, fight, and win in air, space, and cyberspace. The necessary degree of control in air and space, and the ability to operate effectively in cyberspace, are essential to provide the joint force with freedom to conduct operations and prevent an adversary's effective use of these domains. The Adaptive Domain Control mission includes the ability to operate in and across air, space, and cyberspace to achieve varying levels of domain superiority over adversaries seeking to exploit all means to disrupt friendly operations. Domain superiority is that degree of dominance that permits the conduct of friendly operations at a given time and place without prohibitive interference by an adversary. Space and cyberspace capabilities have become as integral as air capabilities to the Air Force's approach to *integrated multi-domain operations,* which exploits opportunities and protects vulnerabilities.

The actions of AF air, space, and cyberspace forces, which occurred in the past as largely disconnected operations, are now integrated to achieve Adaptive Domain Control. In collaboration with joint and multinational partners, AF forces perform sensor and shooter functions that enable them to see first, act first, and neutralize or kill an adversary. To provide the freedom to conduct operations, AF forces pursue adaptive domain control using capabilities from all domains. If the ability to act in one domain becomes limited, AF forces apply efforts in and from the other domains to achieve the required objectives. Cyberspace and space assets act in concert with air assets to produce certain effects. Conversely, kinetic and non-kinetic air operations can be directed towards achieving space or cyberspace effects as well as effects in the air domain. These numerous combinations of air-to-space-to-cyberspace operations can proceed in all conditions, to include highly contested or inhospitable environments, and their flexibility provides resilience amid the enduring uncertainty of war.

Performance-optimized teams of air, space and cyberspace assets, operating within mission command and appropriate authorities, are locally networked to operate with mutual support, using manned and uninhabited platforms in various proportions according to mission needs. These teams leverage different strengths depending on their compositions, and their modular nature presents complicated targeting problems for adversaries. Component parts of these teams provide superior offensive capabilities and solid defensive applicability; they are capable of collecting with multi-spectral sensors, exploiting the electromagnetic spectrum to generate effects, and delivering destructive, disruptive, or non-lethal effects in the physical domains and within cyberspace. Teams can aggregate to produce mass when required or be distinct, disparate assets, depending on the required domain control effects.

4 SEP 2035
2209Z

Space Control Challenged

Capt Deckard expected his day at the MDOC would be quiet despite increasing tensions over access to maritime LOCs. His primary duty was space assurance, to preserve the joint force's ability to gain and maintain space superiority. Most threats these days involved wayward debris and unintentional electromagnetic interference. This morning's warning of an imminent ground-based laser (GBL) attack on a satellite, on the other hand, foreshadowed a very memorable day.

Current intelligence indicated the intended target was a commercial imagery satellite. There were no prior warnings of an impending attack, and the GBL indicators did not correlate with any known adversary GBL locations. "What is this guy up to?" Capt Deckard wondered. He quickly ran a correlation algorithm based on the GBL location and its likely operating parameters, and the orbits of all commercial imagery satellites, to determine possible attack scenarios. Within a few minutes the computer had generated several thousand scenarios covering the next 72 hours. Adversary behavior patterns, meteorological data, and engagement physics reduced the scenarios to a handful of most likely engagement opportunities. One of the opportunities was only 15 minutes away—against a recently launched high-resolution, hyperspectral imaging satellite. This was getting serious.

Capt Deckard directed his computer to perform high-resolution simulation of the imminent event in order to generate COAs to prevent or minimize damage. Almost immediately, the system generated a simulation of the event, displaying relevant force structure, force availability, and multiple-order effects. Networked systems across the defense enterprise shared information and processed massive quantities of data rapidly to generate and evaluate cross-domain COAs, which appeared on the display based on probability of effectiveness. With only minutes until the engagement window, the COAs narrowed to a set of pre-coordinated, pre-approved actions. Capt Deckard selected a preprogrammed offensive cyberspace COA against the adversary's offensive space targeting algorithms.

As Capt Deckard watched the display update in real-time, the imaging satellite's icon suddenly changed from blue to red, indicating a significant operational event. At the same time, space-based sensors detected a high-energy event originating from the location of the suspected GBL. As the MDOC erupted with activity, Capt Deckard recognized the COA had failed. He now shifted his attention to the subsequent computer-generated attack scenarios. He was determined not to lose another satellite.

2035's AF forces have robust space mission assurance capabilities, including the resilience to operate effectively in this important and increasingly contested, degraded, and operationally-limited domain. AF forces are able to perform defensive space control operations, increase resilience of space systems and architectures, and improve reconstitution capabilities to ensure U.S. and Allied use of space through all phases of conflict. Over the past few decades, the use of space has proliferated internationally and many nation-states are now exploiting space systems as a force multiplier to conduct operations. Consequently, the Air Force has developed an array of capabilities to deny hostile use of space systems. Air Force operations to exert space domain control are balanced against the long-term impact to the space environment to minimize unintended consequences.[9]

9 See JP 3-14, Joint Doctrine for Space Operations (29 May 2013), II-8: "Offensive Space Control…Adversaries, both state and non-state actors, will exploit increased access to space-based capabilities to support their operations.

Space situational awareness (SSA) and the ability to coordinate and deliver space effects are crucial to control in the space domain. The persistent observation of the space environment enables identification/characterization of threats, attribution of hostile activities and coordination of active defensive measures. SSA information from ground, air, and space sensors owned by the DoD, Intelligence Community, the space commercial enterprise, and allied partners contributes to the MDOC COP. Airmen use this fused and accessible information to ensure freedom of action in space for the joint force. Routine and operationally-responsive launch operations from both ground sites and airborne delivery vehicles establish and maintain effective satellite constellations. AF spacelift capabilities provide timely launch to support mission needs for agile space capabilities. Space launch capabilities enable flexible employment of short-term, space capabilities including space control and reconstitution of lost or degraded space capabilities. Airmen with robust training in space operations are proficient in tactics, techniques, and procedures (TTP) to preserve our freedom of action in the face of adversary attempts to deny or degrade our advantages in this domain.

7 SEP 2035
0315Z

Satellites On-Demand

Captain Miller released brakes and selected full afterburner; her F-35D sped down the runway and lifted off. In response to the adversary's offensive degradation of U.S. space capabilities using ground-based lasers, her primary task was to provide on-demand launch of a satellite cluster for rapid reconstitution of space capabilities. Three minutes later at high altitude, she eased over into her acceleration profile, then smoothly lifted the nose and thumbed-down on the pickle button. The modular satellite booster separated from the aircraft and bolted spaceward. Once it achieved its orbital position, the clustered, expendable micro-satellites deployed into their network formation. Their dispersed formation presented complicated targeting problems for adversary space-domain-control assets. The cluster used electromagnetic-spectrum measures to disrupt an adversary attack on other U.S. space assets. An hour later, from their vantage in the space domain, the satellites focused onboard sensors on an area of interest. The cluster also extended their network connectivity to a joint/multinational airborne strike package en route to coastal-defense-cruise-missile targets in adversary territory, providing situational awareness of threats in the target area.

Low on fuel and with minimal weapons, Capt Miller turned northward to rendezvous with a cell of uninhabited air refueling tankers. Once topped-off, she rejoined with a waiting formation of fully-armed, semi-autonomous wingmen, linked them to her network, and proceeded to her planned air defense combat air patrol location--one mission down, one to go.

The ability to operate effectively in cyberspace is even more essential than it was in 2015 to gain the required level of freedom of action in all warfighting domains to enable full-spectrum operations. Cyberspace operations create significant effects to execute, enhance and support AF core missions and to disrupt or deny adversary operations. In 2035, Airmen operate in a constant state of competition and conflict in cyberspace against a variety of state and non-state actors. Where able, Airmen conduct operations on a modernized, resilient, multi-level information network which uses state-of-the-art encryption technology and secure information brokers to ensure secure, on-demand communications and data transfer. This network includes closed components that are fully secured against intrusion, while other systems enable Airmen to operate amid the global information environment. AF cyber forces are postured to conduct offensive, defensive, and other relevant network operations in coordination with other Services, agencies, and the Intelligence Community. Airmen serving on cyber teams are experts with specialized training in cyberspace operations throughout all five AF core missions and in support of national objectives. They have the skills to operate and maneuver tactically and operationally in cyberspace with the appropriate authorities to achieve desired effects rapidly. In a contested cyberspace environment, a focus on precise, predictable effects, fully synchronized with actions planned in the other domains to include Information Operations (IO), enables AF cyberspace operations to ensure the required degree of freedom of action.

Dynamic command and control enhances collaboration for adaptive domain control through common systems and cooperative planning. Collaboration enables operational planners to leverage effects from multiple domains to cover any vulnerabilities. *Dynamic command and control* can allow air, space, and cyberspace forces to operate under centralized control through decentralized execution, enabling operational level commanders to respond to changes in the operating environment and take advantage of fleeting theater-wide opportunities. In degraded or distributed conditions, *dynamic command and control* can also allow AF forces to operate as local networks, within commander's intent, to exercise disciplined initiative and maximize tactical flexibility to achieve mission objectives. Proximate local networks are able to operate with mutual support, merge, or disaggregate according to mission needs. Airmen at all levels are trained to execute adaptive domain control operations under the appropriate model and degree of C2.

During crisis response operations, the mechanics of achieving freedom of action across air, space, and cyberspace may be less kinetic than during major combat operations, but the role of domain control in compressing the data-information-intelligence timeline remains important. In situations where we must respond quickly to either natural or man-made disasters, the most pressing challenge is often time—a fight to save people from imminent danger or counter the effects of disease and destruction. AF forces operate in concert with other members of the joint force, international partners, and non-governmental organizations (NGOs) to achieve shared objectives. AF forces are rapidly able to move into austere locations and establish control of aerial ports and associated airspace to provide security, order, and safety. Agile space capabilities provide timely coverage and enabling capabilities to these operations. Effective cyberspace operations during crisis response focus on strengthening the flow of decision-quality information, extending communications and restoring and rerouting networks to remote or disrupted areas. AF forces have the ability to rapidly assess and map surviving cyberspace infrastructure in order to prioritize employment and reconstitution recommendations to joint force commanders. AF cyberspace control in crisis operations creates a conduit for effective messaging operations to friendly, neutral, and hostile actors in an operating area.

AF forces operate with a *balanced capability mix* composed of manned, remotely operated, semi-autonomous, and autonomous air, space, and cyberspace assets, including sophisticated systems to achieve adaptive domain control against advanced adversaries and lower-capability systems for actions against a reduced or less-capable array of threats. AF forces present these assets in various combinations and proportions according to mission needs. Certain domain control assets have long range and high endurance to ensure global reach and persistence. Low observable platforms shrink adversary warning times and targeting opportunities, while other vehicles are small, numerous, and purposefully detectable as inexpensive decoys (albeit with collection and communications network capabilities). Small air and space vehicles may be delivered or deployed from a variety of airborne assets, including air mobility aircraft. When mission needs dictate, some uninhabited systems can conduct increasingly autonomous operations under appropriate degrees of human supervision, such as human battle managers in control of large numbers of self-coordinating vehicles or programs. This flexible arrangement of human-system integration relies on advanced automation to reduce human task loads, enabling Airmen to focus on critical activities like situational understanding, mission-objective selection, and targeting.

AF forces align with partners to develop interoperable, adaptive domain control capabilities through aviation, space, and cyberspace enterprise development, advocacy, training, and combined acquisition programs. AF forces operate with the spectrum of partner capabilities to achieve domain superiority through unified action against adversaries, including those that pose advanced threats to joint/multinational force efforts in any domain. AF forces engage with counterparts from allied nations to gain understanding of partner air forces'

operations, mutually increase capability, and enhance effectiveness for joint/multinational force commanders. Combined acquisition programs, where mutually beneficial, help build interoperability as well as share research and development responsibilities to foster technological progress across common operating domains. The Air Force is capable of rapidly identifying, acquiring, and fielding commercial off-the-shelf solutions to domain control challenges.

18 SEP 2035
2315Z

Human-Systems Integration at the Tip of the Spear

"Risky Flight… commit."

Risky 1 and 2 selected full afterburner to accelerate their F-35Ds to Mach 1.5, propelling Captain Miller and her wingman out ahead of their accompanying formation of multi-mission, long-range (MMLR) uninhabited aircraft. The F-35Ds needed to get closer to the enemy in order to provide high-fidelity cueing to the long-range shooters. Capt Miller's situation display, fusing data from multiple airborne and surface sensors, space assets, and real-time intelligence inputs, showed her a gorilla-sized wave of enemy fighters, cruise missile shooters, and decoy aircraft, all protected by a blanket of electromagnetic jamming. At least the friendly jammers would give similar protection to her formation. Risky Flight had to take out the enemy bombers before they launched their hypersonic cruise missiles—otherwise the carrier strike group would be overwhelmed.

"Risky Flight, target North package."

Scanning the holographic skies from the ground control station of Risky 3, Capt Dawson could sense the adrenaline in Capt Miller's voice; the two pilots had flown together many times in training sorties and exercises, honing their skills and teamwork to a razor's edge despite having never met in person. Capt Dawson maneuvered his MMLR into firing position and unleashed a salvo of long-range missiles. His display flickered briefly and then recovered; another foiled enemy attempt to block his link. At the relay station, a team of space and cyber operators under the command of Lt Burton continuously shifted signals between satellites, keeping one step ahead of the enemy hackers.

"Risky 3, lost link."

"Risky 1—I have the aircraft."

Capt Miller's laser datalink came to life as she took direct control of Risky 3's MMLR. The enemy had finally blocked the MMLRs' satellite link by using barrage jammers to blanket the entire SATCOM band. That meant the enemy would not be able to use their in-band assets either—they must be getting scared! Capt Miller recommitted the now-semiautonomous MMLRs on the South package while she and her wingman used their on-board weapons to destroy the remaining bombers in the North package. Since even the laser datalink was not invulnerable, the team had also programmed the MMLRs to conduct fully autonomous cruise missile defense if all communication was lost. Capt Miller's display showed that two MMLRs in the adjacent lane had been forced into autonomous operations, but so far her datalink was holding strong. The same could not be said of the enemy strike packages. Just then Risky 3 checked back in with a restored satellite link—Lt Burton's cyber ops team had come through again. Today was shaping up to be a good day.

Global Integrated Intelligence, Surveillance, and Reconnaissance (GIISR)

ISR plays a fundamental and constantly-increasing role in how the joint force maintains situational awareness, conducts and assesses operations, and employs force against adversaries. GIISR continues to enable current and future operations through the cross-domain synchronization and integration of: planning and operation of ISR assets; collection using near-ubiquitous sensors; and processing, exploitation and dissemination (PED) of finished intelligence. GIISR also includes the integration of collection and analysis, and evolved production capabilities across the globe. ISR is conducted in, from, and through all domains, in all phases of operations, and in complex operating environments ranging from permissive to highly-contested. Simply put, ISR is the foundation upon which every joint, interagency, and coalition operation achieves success.

At its core, Air Force ISR is about enabling leaders to make informed decisions at a *superior decision speed* to help ensure freedom of action, maintain deterrence, contain crises, and achieve operational success. ISR focuses on operational outcomes and the closing of intelligence gaps. Enduring Air Force ISR capabilities include: Intelligence Analysis to characterize the battlespace and understand and anticipate adversary capabilities and intentions; Collection Operations to plan and employ ISR sensors and platforms to gather data; Targeting to select and prioritize targets, match appropriate actions to achieve desired effects, and dynamically provide battle damage assessment; and Operations Integration that enables core AF capabilities and provides Intelligence Mission Data to the increasing number of information-based weapons systems.

Agile operations require dynamic and elastic ISR forces and capabilities to provide actionable intelligence to commanders and to increase understanding of the environment and an adversary's capabilities and intentions. Operating within the Defense Intelligence Information Enterprise (DI2E), the data-information-intelligence timeline that was once burdened by classification barriers and limitations to sharing of information has been shortened and provides advantageous options for decision makers. Command, control, communications, computer, intelligence, surveillance, and reconnaissance (C4ISR) systems utilize the Joint Information Environment (JIE) and Intelligence Community Information Technology Enterprise (ICITE) to provide confidentiality, integrity, and availability of data at the point of need to produce actionable intelligence. The sharing of information in near-real time with other Services, U.S. Government (USG) agencies, allies, partners and, when prudent, private companies and individuals, enhances the potential for national leaders to take unified action at a *superior decision speed*.

A fully developed cadre of Air Force ISR professionals, with deep expertise in information fusion, has revolutionized analysis and exploitation processes. Empowered to innovate, ISR Airmen lead the way in the development of TTP that will compress Observe, Orient, Decide, Act (OODA) loops, and produce actionable intelligence needed to complete kinetic or non-kinetic equations.[10] For global ISR tasks, the process of combining information elements into a COP now includes crowd-sourcing techniques rather than a single formal program. ISR Airmen work with operators and outside agencies to integrate Big Data processes and human cognition as part of *performance-optimized teams*. Airmen are the power behind the AF ISR enterprise and they are trained to make decisions in a dense information environment. Equipped with honed critical thinking and collaboration skills, ISR Airmen are masters of threat characterization, analysis, collection, targeting, and operations-intelligence integration. They are comfortable operating within the fog and friction of military operations. Such skills are garnered through education, training, and experience in live-virtual-constructive scenarios that focus on cultivating the ability to make accurate decisions in information-challenged environments.

10 Air Force ISR 2023: *Delivering Decision Advantage*, 6.

18 JUL 2035
1803Z

ISR in the MDOC

Captain Jenkins, an Air Force Reserve Intel officer, was responsible for working the regional desk at the Rapid Assessment Function Team within the MDOC. In his civilian job, he was a computer programmer and data analyst for a leading information technology company. During a watch shift while on Reserve duty, Captain Jenkins received an auto-notification that local web-surfing trends, social media and online purchasing activity in an increasingly belligerent country of interest over the past 30 days were indicative of high risk behaviors consistent with an attempt to restrict navigation through an essential maritime line of communication. Capt Jenkins validated the information, and ran a query for recent abnormalities in human activity in the region. He then compared the activity to the 30 days and to similar periods in the last few years using an automated algorithm that combined relevant information from a number of sensors and databases—his combined military training and civilian experience had definitely prepared him for this type of work. He understood the need to quickly find the most pertinent data to update the COP and relay to the Strategic Design team in order to inform their immediate activities. After gathering sufficient information, Captain Jenkins notified the watch floor supervisor of his findings and intention to relay the information via secure transmission.

The agile AF GIISR enterprise is equipped with a *balanced capabilities mix* including new ISR collection and PED methods; technologies allowing near-instantaneous and secure communications; and the ability to leverage the commercial infrastructure in air, space, and cyberspace. In highly contested environments, static and unadaptable communications systems are no longer sufficient. They have been replaced by a more distributed, dynamic, and automated network. No longer restricted by a dogmatic hierarchy, the enterprise provides intelligence in machine-consumable formats that is integrated and disseminated at multiple levels of planning and execution to meet the varied needs of users, including joint forces and partners. Incorporation of a truly global COP now allows ISR forces to leverage the vast amount of information collected by a large number of users.

Essentially, with near-ubiquitous sensing and information environments, every Airman is now both a contributor to and a participant in the ISR enterprise. The new infrastructure enables extensive data-mining, collaboration and teaming while cross-cueing other systems to collect additional data as gaps in information are identified. Moreover, new analytic methods of object-based intelligence production (OBP) and activity-based intelligence (ABI) are sensor-neutral and PED is increasingly automated, increasing operational flexibility and enabling the joint/multinational force to gain and exploit decision-quality information on-demand. *Teaming* of these automated systems with humans in the loop at appropriate points is especially crucial in cyberspace, where the speed and ubiquity of information makes human processing infeasible. Information is injected into the COP at its first level of useable refinement (often directly from the sensor, but sometimes not until humans can assess it) so that end users can ingest it into their specialized mission systems and react quickly. Simultaneously, intelligence professionals and systems fuse the data with multiple sources and analyze it for deeper characterization. This refined intelligence is also published to the COP, where it can be linked to the originating data to ensure accuracy, relevance and timeliness. Refined intelligence can be scrubbed of originating data while retaining pertinent meta-tags, facilitating sharing at lower classification with partners.

The COP enhances the ability to find and track enemy forces and permits faster and more effective integration of fires across components and domains. In their UDOPs, users will subscribe to certain types of data and intelligence publications to ensure timeliness and relevancy. In certain cases, ISR Airmen will push time-critical intelligence directly to specific users. This construct increases the speed and fidelity of decision cycles, and enables the sharing of information using like data sets to answer different questions at different rates and volumes. All collections are published in structured information objects consumable by humans and machines alike, streaming smoothly

across multiple domains and organizational structures and feeding directly into analytical decision and execution tools.

The use of technologies like micro-satellites, high-altitude atmospheric platforms, and myriad uninhabited sensors combines with improved interagency connectivity to provide more comprehensive and advantageous battlespace awareness. Moreover, a sensor-neutral approach to collection helps to overcome adversaries that are also able to share and manipulate information to achieve occasional technological or operational surprises. While the increased presence of commercial assets in space enables the Air Force to leverage more data sources to swiftly support decisions, it also results in information once considered the sole purview of nation-states being widely available for the average person at relatively low cost. Today, U.S. national security space capabilities no longer reside exclusively on large, high-cost, multi-mission satellite platforms. In prior decades, such concentration resulted in vulnerability to adversary offensive counter-space actions. Space defense—a broad approach to mitigating attacks on space assets—can help assure that the DoD and the Intelligence Community retain use of space assets without prohibitive disruption. By disaggregating and dispersing space missions, functions, or sensors across multiple systems and domains, and using other "whole of government" solutions, the Air Force—as the DoD's Executive Agent for Space—is able to provide resilience, reduce vulnerability, and *balance* performance with cost effectiveness.[11]

6 AUG 2035
0130Z

A Performance-Optimized Intelligence Team

TSgt Jones, an intelligence analyst in the MDOC, was tasked to examine an incident of civil unrest in the same vicinity of recent insurgent activity against a partner nation. After composing and executing her query, and defining a geographic and functional area of interest, she anxiously stood by while the system collected data from a variety of sensors. The system returned not only information on the event in question, but also relayed that a fellow analyst was examining a similar event in a neighboring nation, and that two other similar events of the past week were under examination by FVEY analysts elsewhere in the region.

After reviewing the project folders of the other analysts, TSgt Jones followed a threaded, collaborative discussion about insurgent concentrations and movements along the border in question and a report from a nearby NATO reconnaissance aircraft of sporadic communications jamming. After further collaboration with her intelligence team, TSgt Jones produced an intelligence estimate that projected an impending insurgent offensive in the immediate vicinity of a forward-deployed Special Forces Company. There was no time to lose—the Green Berets were in imminent danger and, despite their robust capabilities, this offensive had the potential to overwhelm them.

ISR operations also include robust sharing, and development of intelligence with international partners who directly contribute to battlespace characterization across the full range of

11 AFSEA, 2014-2034, 21.

military operations. AF forces work closely with partners to develop strategies that are more affordable, scalable, interoperable, and are flexible enough to shift among domains in order to mitigate risk, assure friends, and deter foes. Integration of ISR operations with partner nations, other government agencies, and commercial entities remains fundamental to long-term global vigilance within each domain and across the range of military operations.

Rapid Global Mobility

Effective, responsive, and precise Rapid Global Mobility (RGM) underpins Global Vigilance, Reach, and Power through innovative capabilities and approaches. Demanding global commitments require this essential combat delivery and sustainment mechanism for the joint force to act within the rapid tempo of emerging operations. At its core, RGM has always focused on the relocation of manpower and physical materials, but this process now occurs through a much wider portfolio of physical—and virtual—methods across multiple domains.

RGM's historical contribution to power projection, deeply rooted in the air domain, is still visible through its airlift, air refueling, and aeromedical evacuation components; however, RGM functions have broadened to encompass both the space and cyberspace domains. Access remains the key challenge to the United States and its allies as they negotiate the contested global commons to provide desired effects. RGM's ability to provide or enable required power projection around the globe, through air, space and cyberspace, helps mitigate challenges to access. Mobility forces use more tailored, temporary solutions to provide operational support than they did in 2015, requiring Airmen to be more agile in order to provide end-to-end support across domains. Airmen integrate transport with the ability to open and operate robust, efficient air logistical nodes; conduct responsive delivery of payloads to space; coordinate cyberspace access points and networks; and work in austere locations within compressed timelines.

RGM assets harness the power of total asset visibility and fully integrated information systems with predictive analysis to provide *superior decision speed* for users, planners, and operators. In the past, mobility Airmen had to manage mobility data across multiple discrete, and often incompatible, information systems. The process is now streamlined significantly with integrated systems that flow vital information across the RGM enterprise from a variety of sources including joint, multinational, and commercial partners. The data generated enables predictive analysis to forecast requirements and anticipate changes, while global MDOC personnel leverage automation and robust connectivity to reduce manpower requirements at forward locations.

RGM employs a *balanced capabilities mix* of manned, remotely operated, and autonomous assets to support operations in both contested and uncontested environments. Manned and remotely piloted airlift aircraft deliver materiel via a variety of precision parachute-based airdrop platforms and self-propelled cargo drones. In contested spaces, a large quantity of expendable, autonomous drones can collectively provide mass resupply without risking the loss of Airmen or individual high-value RGM assets. In uncontested environments, efficient platforms like hybrid airships support large, expeditious lift requirements to forward-based logistics nodes. Advanced materials and bio-fuel production enable rapid construction of expeditionary airfields. The old limiting factor of working maximum on ground at many nodes, driven by limited handling equipment and Contingency Response (CR) manpower, has been eliminated by semi-autonomous, self-loading wheeled pallets.

5 AUG 2035
2305Z

Aerial Port of the Future

MSgt Porter walked through the cargo yard of the newest advanced aerial port, and reflected on the changes he'd seen over his 20 years of service. As he passed robots actively packing a pallet of MREs, he reviewed the validated cargo set to depart the port that day. He smiled and shook his head as the validated message changed for the fourth time in an hour, prompting a flurry of movement from previously dormant packing and pallet-loading robots. He knew that within minutes that flurry would subside, but for just a moment he stopped to think about what prompted all this commotion.

Thousands of miles away, mission orders were being published at JTF-FREE TRADE, directing a joint task force to engage a belligerent state actor that was attempting to close a maritime LOC. Simultaneously, a joint special operations task force (JSOTF) was conducting foreign internal defense missions in this area of responsibility (AOR). As orders left the servers at the JTF, Big Data systems designed to specifically anticipate the logistics needs of fielded forces digested those orders. They viewed those commands against real-time intelligence assessments, historical trends of the force and the enemy, and weather forecasts. Based on that assessment, the system anticipated the needs of the disparate forces before they moved out, and updated the cargo preparation system at MSgt Porter's advanced aerial port. While not perfect, the system routinely anticipated needs that even the savviest commanders might not foresee—saving lives and speeding mission success.

MSgt Porter lowered his handheld Automated Load Planner, focusing his gaze on the aircraft being loaded on the tarmac with its primary cargo and its quick-reaction flex package. The whir of activity around him provided comfort, as he knew his fellow service members would have everything his team could provide to ensure their success and safety. With that confidence in hand, he started toward the C-130J, mentally preparing for his load brief to Capt Taylor's crew.

Performance-optimized teams are central to effective RGM operations. Mobility Airmen require finely honed critical thinking skills, resiliency, and creativity. Airmen now train and operate with greater flexibility and breadth of experience in dynamic environments due to teaming with prudent automation which simplifies human qualification and currency requirements. Aviators often function as mission commanders with the support of autonomous or semi-autonomous wingmen. Additionally, by tapping into standardized datalink services, Aeromedical Evacuation forces are able to leverage virtual specialists to respond rapidly to patient needs through robust communications and *dynamic command and control*.

The Air Force remains the preeminent leader in rapid large-scale mobility operations, conducting *integrated multi-domain operations* using a *balanced capabilities mix* that bridges previously distinct disciplines. The integration of air and space lift has become essential for sustainment and replenishment of space-domain assets. The Air Force executes both surface-launched and air-launched space lift missions to transport materials, assets, and personnel to space. A strong relationship with commercial partners through the Civil Reserve Space Fleet supplements steady-state needs, providing scalable capacity for rapid and responsive space lift to support operations in air, space, and cyberspace, and adds an element of resilience and surge capacity

in space assets. Mobility operations in space have expanded to include transport of personnel and servicing of space assets, be it fuel replenishment or repair/mission enhancement through replacement of mission modules and the movement of space assets within or between orbits.

While not directly analogous to the traditional moving of people and things, cyberspace transport includes the precision delivery of and sustainment of data to friendly forces in a contested environment. Additive manufacturing is enabled by cyberspace transport of 3D-printing instructions. This capability further blurs the line between mobility and cybersecurity by allowing the provisioning of physical goods through virtual methods. Additive manufacturing streamlines supply chains and revolutionizes logistics across the domains. At the enterprise level, RGM assets extend the physical transportation network by creating expeditionary nodes connected through en route structures. Similarly, cyberspace mobility includes the physical deployment of network nodes and the sharing of data links from surface, air or space assets to create cyber access points for the flow of critical information to supported forces during operations. Air and space assets carry a cyberspace node on-board that can be activated or deactivated as required to extend cyber access points in areas where they are needed.

For air refueling in an A2/AD scenario, manned tankers lead formations of uninhabited refueling aircraft in a master-dog relationship. Designed, fielded, and modified through an agile acquisitions process, these uninhabited extenders leverage both passive and active defenses to enable refueling operations partway inside threat areas, while the parent tanker provides line-of-sight C2 and periodic replenishment to these assets.

Mobility Airmen also rely on strong relationships with joint, interagency, multinational, and commercial partners to build *performance-optimized teams.* Interoperability and widespread standardization allows joint forces, allies and partners to participate in integrated transport and refueling, ensuring maximum effectiveness and efficiency during operations. Access in air, space, and cyberspace is often facilitated by multinational or commercial partners. Multi-domain mobility remains a highly valued capability across a wide range of partners with different security needs. Many partners continue to require U.S. assistance to move and sustain their people and equipment in any domain on short notice. Other partners are more interested in developing their own mobility capabilities and assets with the support of U.S. RGM forces. Still others prioritize building or improving civilian transport capabilities and infrastructure to promote economic development, stability, and the ability to support U.S. and multinational operations. Additional capacity in RGM operations is augmented by the capability of commercial partners through programs like the Civil Reserve Air Fleet, the Civil Reserve Space Fleet, and its cyberspace equivalent. All of these efforts enhance access and mitigate capacity issues in support of operations.

6 AUG 2035
0259Z

Special Forces Resupply

"One minute!" announced Captain Taylor as the cue flashed in his HUD.
"Acknowledged." Senior Airman Ortega replied from the cargo compartment of the C-130J.

Captain Taylor continued on the run-in for an Enhanced Joint Precision Aerial Delivery System (E-JPADS) airdrop. His crew's mission for the day had been redirected from a basic logistics run to an emergency airdrop of a container of polycarbonate—an additive manufacturing material—to a Special Forces outpost that had been isolated by recent indirect attacks. The outpost's complement of Gray Falcons had been out of commission due to a pre-dawn mortar attack that had damaged its ground control station. The Special Forces company needed to manufacture a critical part to complete repairs and launch their UASs for armed over-watch. Indications and warnings suggested a direct attack was imminent.

An uninhabited cargo drone had attempted to deliver the part as soon as they submitted the request, but the adversary's broadband jamming in the area had triggered the drone's emergency return protocols. A manned airdrop was the only way to ensure delivery in this environment. Instead of launching a new airlift mission or tasking a crew to return to the staging base to pick up the part, planners at the MDOC had determined that it would be faster to re-task Captain Taylor's airborne crew to drop the polycarbonate and manufacture it on site with the outpost's 3-D printer.

While the C-130J flew the run-in to the release point, the team in Lieutenant Burton's cyber operations cell in San Antonio worked together to compile and deliver the file containing the part specifications to the outpost's 3-D printer. The adversary had used a combination of jamming and cyber-attacks to isolate the outpost. Lt Burton's team routed the data through multiple space-based assets to build a secure connection for the download.

"Five Seconds…" "Green Light!" SrA Ortega watched the airdrop container roll over the edge of the ramp, and out into the airstream. *"Load Clear."*

The C-130J continued to orbit at high altitude to provide line-of-sight guidance information to the E-JPADS unit as it glided toward the outpost unhindered by enemy efforts to jam GPS signals in the area. As the download completed, the airdrop container settled safely within the confines of the outpost, ensuring no soldiers had to leave the wire to secure a drop zone. Within minutes, the soldiers prepped their 3-D printer and begin to see the first hints emerge of the replacement part for their ground control station. What would have taken days and millions of dollars to manufacture and airlift into theater from CONUS was now being built at the tip of the spear. The tooth and the tail had become one and the same.

Global Precision Strike

In 2015, Airmen conducted global strike using a legacy planning and execution model that concentrated on cyclical, kinetic air operations with space and cyberspace efforts as purely enabling functions. Today, the global precision strike discipline considers air, space, and cyberspace as an integrated operational environment. Capabilities from any domain can contribute to precision effects in and across all five domains. In order to maximize *operational agility* against advanced adversaries, most strike missions include closely integrated operations and effects in more than

one domain. Precision strike effects are well-timed, synchronized, immediately assessable, and scalable to minimize provocation and avoid unintentional escalation. Airmen collaborate with joint and coalition counterparts and with networked experts worldwide to synthesize combinations of kinetic/non-kinetic, lethal/non-lethal, direct/indirect, and permanent/reversible effects, striking targets in hours, minutes—or seconds.

Decades of evolution in domain integration enable AF assets to conduct *integrated multi-domain* global precision strike using a *balanced capabilities mix* of forces, in collaboration with joint and multinational partners. AF precision strike assets link together locally and across global distances to provide collaborative sensing, processing, analysis, engagement, and assessment to feed a dynamic, responsive targeting process. Manned, remotely operated, semi-autonomous, and autonomous assets conduct global precision strike operations as networked, *performance-optimized teams* that can rapidly aggregate, maneuver, build situational awareness, and deliver precise effects throughout the range of military operations, on missions ranging from strategic attack to close air support (CAS). Many precision strike systems can be operated remotely by Airmen located anywhere on (or above) the planet, or teamed with manned assets that can control them directly using intuitive interfaces. Professional, proficient Airmen are the cornerstone of this innovative approach.

The Air Force global precision strike includes a *balanced capabilities mix* of assets that act as *performance-optimized teams*. The Air Force is less concerned with exquisite platforms and more focused on striking with precise, predictable effects. In the air domain, high-end manned and uninhabited precision strike assets are low-observable and have long range, high endurance, and mission-configurable payloads. Less exquisite systems, obtained via an agile acquisitions enterprise, provide lower-cost options to support precision strike missions in highly contested environments (as expendable decoys, for example), and for operations in permissive environments. These assets include several classes of modular platforms that can be configured with combinations of sensors, decoys, electromagnetic jammers, and munitions (with both lethal and nonlethal effects). Small uninhabited vehicles can be deployed from a variety of air or surface assets to accomplish or enhance precision strike missions.

AF space assets include a balanced mix of highly capable, defendable assets that operate in networked, resilient constellations to provide space control, ISR, communication, and position, navigation and timing (PNT) capabilities. These space domain capabilities can be further expanded through smaller launch on-demand systems when rapid/responsive effects are required. Space systems are built, deployed, and operated to be resilient in the face of hostile activity, including various means to neutralize threats to friendly space operations. When a capability in space is threatened or attacked, Airmen are able to “operate through” the threat, rerouting required tasks to other platforms in space or in another domain until full function can be restored. High-end AF vehicles can transit through the space domain to deliver effects at hypersonic speed across global distances.

In 2015, most air planners only marginally understood nascent cyberspace capabilities, and consequently they relegated them to underutilized roles in operations. In 2035, cyberspace capabilities are seamlessly integrated into global precision strike operations, giving decision makers an agile suite of kinetic and non-kinetic options to produce precise, predictable effects. Cyberspace effects can be delivered from a wide array of Air Force platforms. They can be temporary and reversible, or they may create significant, lasting effects. A precision strike in cyberspace may preclude kinetic operations, it may be a vital enabler for ongoing or follow-on activities (to include deceiving adversaries as to the location or intent of joint forces), or it may deliver the ultimate, decisive stroke of a complex multi-domain operation.

12 SEP 2035
0030Z

The Cyber HARM[12]

Lt Burton's cyber ops Airmen contemplated how they would employ their HARM-like weapons in cyberspace to detect a specific enemy activity and respond with a precise, predictable effect. They had a number of delivery options to evaluate. Cyber HARMs could be launched from cyber units stateside or from forward-positioned network entry points. They could also be inserted via directed-energy systems on manned or uninhabited platforms, as payloads inside "fire-and-forget" munitions, embedded in other signals. No adversary network—even one ostensibly closed to outside connections—could be made entirely secure. Once deployed, Cyber HARMs could "loiter" indefinitely, adapting their algorithms using highly autonomous logic and reporting back periodically as the situation warranted. This adversary was no fool; they had buried their industrial control systems inside a fiber-optic network that was disconnected from external connections. In this case, the choice was clear: Lt Burton suggested a covert insertion to deploy the weapon.

The SEAL team completed its infiltration, stealthily slipping into the underground conduit containing the enemy's secure network. There, they tapped into a fiber-optic line and inserted a virus that would lock a certain elevator in the up position. "Those flyboys had better be good," thought the SEAL Team Lead; once triggered, the effect would only last for 30 seconds or so. "And locking up an elevator? That's an odd way to 'fix' a target," he mused, as they deftly completed their exfiltration.

A significant component of *superior decision speed* is an unprecedented level of collaboration with partners, first and foremost being the joint team. This collaboration increases the responsiveness and effectiveness of the global precision strike mission. Gone are the days of incompatible systems, concepts, and procedures between the Air Force and its sister services. AF forces conduct frequent joint and multinational training, exercises, and technology development using live, virtual, and constructive venues. This integration allows joint forces to conduct precision strike operations readily as *performance-optimized teams* in unexpected or quickly changing situations.

Effective international partnerships further enable AF global precision strike to create desired multi-domain effects within a compressed planning process. Multinational engagement and security cooperation is not limited to partner air forces, but also includes training and direct support to the ground and maritime forces of partner nations. This collaboration is critical for cases in which the U.S. must rely on partners to augment Air Force capacity, or for shared access to basing and other infrastructure in crisis regions. While technologies and CONOPS have reduced reliance on proximate access and presence, some forward basing remains necessary for global precision strike. Tailored forward presence enables sortie generation for short-range platforms, footprint coverage for space operations, discrete entry points into cyberspace, and special operations. Expeditionary AF forces operate from small, resilient airbases, using dispersal, warning, active and passive defenses, and rapid repair capabilities to survive and continue to fight. They are able to enter networked operations to synchronize precision strike effects in close cooperation with joint and multinational partners across all five domains.

AF forces leverage multi-domain standoff strike capabilities whose effective ranges exceed those of an adversary's defensive systems to engage high-value, time-critical, and highly defended targets, while reducing risks to mission and friendly forces. This standoff range may exist due to tangible distance in the air or space domains, or it may be a result of cyberspace operations or electromagnetic capabilities that deliver friendly effects while precluding adversary responses.

12 The AGM-88 High-Speed Anti-Radiation Missile (HARM), developed in the 1980s based on previous designs, was an air-to-surface munition that targeted enemy emitters, predominantly surface-to-air missile radars. More than simply a tactical missile, the HARM was a psychological weapon—enemy radar crews were afraid to turn on their emitters for fear of eating a missile.

17 SEP 2035
2230Z

Hypersonic Weapon Attack

Captain Dawson depressed the release button the instant his MMLRs reached their designated launch point. Six thousand miles away from him, his four-ship unleashed 200 pelican-sized vehicles that accelerated to 0.9 Mach and raced toward the enemy coastline. They rapidly aggregated into an ever-shifting array of decoys and jammers as their networked sensors built situational awareness on the enemy integrated air defense system (IADS).

The enemy quickly detected the mass of incoming projectiles, but the constantly changing picture made it impossible to determine the real targets from the decoys. No matter: their networked missiles and long-range directed-energy cannons would soon decimate this futile attack. Destroyed and disabled vehicles began to fall from the sky, but the remaining units reconstituted and continued inbound.

The enemy did not detect the approaching hypersonic missiles until it was too late. Under cover of the decoy-jammers, another formation of MMLRs had launched the hypersonic munitions from hundreds of miles away. The enemy IADS, saturated by the formation of decoy-jammers, had missed the one fleeting opportunity to target the high-speed munitions. Now in the terminal phase, the hypersonic missiles streaked into their targets. First to be destroyed was the ground-based high-energy laser that had menaced low-earth orbiting satellites for weeks—a cyber attack had locked its elevator into the up position just seconds before the missiles arrived. Other hypersonic salvos destroyed coastal defense cruise missile batteries and attack-boat pens. Finally the joint forcible entry could commence.

Thirty decoy vehicles managed to penetrate the vanquished IADS. Twenty found targets that matched their programmed criteria, striking enemy radar arrays and communication towers with their small integral warheads. The other ten, their fuel expended, self-destructed harmlessly offshore.

Both conventional and nuclear AF forces continue to conduct strategic deterrence operations. AF forces maintain and employ a diverse range of munitions, emitters, and delivery systems capable of delivering scalable lethal and non-lethal options that span the range from exquisitely precise strikes to mass effects. The MDOC enables Airmen to retain C2 at high levels when required, while decentralizing it appropriately for tactical tasks. Air Force long-range strike capabilities provide flexible and responsive means to penetrate advanced defenses as well as signal U.S. resolve while minimizing forward force posture requirements.

Modernization and recapitalization of the Air Force's Nuclear Enterprise have improved the readiness and flexibility—and continued to ensure the safety and security—of our Nation's strategic deterrent. Upgrades to Nuclear Command and Control Communications (NC3) guarantee secure, robust, survivable oversight and direction of the Nation's ultimate weapons. Improvements to NC3 and ISR provide national leadership with enhanced situational awareness and trust in their information, granting *superior decision speed* and a better array of options to

address crises worldwide, while avoiding unintended escalation. The Air Force maintains safe, secure, and effective nuclear forces through professional oversight by leaders at all levels and a tireless institutional focus on the Nuclear Enterprise, regardless of any changes to the number of U.S. nuclear weapons and their delivery platforms. These forces include deployed and stockpiled nuclear weapons; highly capable nuclear delivery systems; nuclear C2; physical infrastructure; and well-trained, disciplined personnel needed to sustain the Nuclear Enterprise.

Air-delivered nuclear weapons and their delivery platforms remain well-suited for the complex, dynamic political/military environment of 2035. The act of placing these forces on alert or deploying to forward operating locations provides a visible indication to adversaries of the U.S. commitment to its alliance partners and international stability. Intercontinental ballistic missiles (ICBMs) continue to provide our most responsive capability, quickly able to attack any target on the globe and impose unacceptable consequences upon an adversary. Air-delivered nuclear weapons and ICBMs continue to ensure first strike stability even in the face of nuclear proliferation. Additionally, AF nuclear forces continue to extend the protection of the U.S. nuclear umbrella to assure our allies and free them from the need to develop or acquire nuclear weapons.

At the other end of the spectrum of conflict, the Air Force conducts responsive, precise, and scalable strikes during limited contingency operations, diligently nesting the effects, timing, and tempo of these activities within broader strategic considerations. Moreover, AF forces' ability to hold targets at risk over large areas with tailored forward presence enables joint forces to influence adversary decision-makers short of engaging in open conflict, while assuring allies of U.S. commitment and resolve. AF special operations are a critical enabler and an integral part of the joint force, building partnership capacity and providing ISR, precision strike, and IO capabilities to enable on-call operations in all domains.

6 AUG 2035
0330Z

Angels on Their Shoulders: Close Air Support in 2035

Major Fischer roared over the Special Forces outpost in his AT-X, dipping his wings in salutation to the troops on the ground. Close on his heels was a four-ship of rugged, heavily armed semi-autonomous wingmen, linked to his controls via laser datalink. The enemy's high-powered jammers had disabled most of the autonomous scouts he had sent ahead. No matter—he had racked up more than 3,000 hours in his aircraft, over a third of them as an airborne forward air controller, or FAC(A), and he was bringing a lot of ordnance to this fight. Maj Fischer had flown operationally for most of his fifteen years of service save one tour as a pilot training instructor, when he'd had the opportunity to teach young fast-burners like Capt Miller in a basic variant of the same aircraft he was flying today.

Maj Fischer established a tenuous link with the Joint Terminal Attack Controller (JTAC), who provided him with the best lowdown possible given the dense jamming environment. The Special Forces had received the C-130J's precision drop and were in the process of printing the replacement part for their disabled ground control station, but it would take an hour to install it. The base was under attack from three sides by enemy soldiers armed with precision mortars and at least two dozen small drones, and the company commander expected a direct assault any minute.

The helmet-mounted display augmented Maj Fischer's picture of the battlespace, fusing data from the JTAC's transmission with overhead collection and the multispectral sensors on his wingmen and his own aircraft. The focused beam of his flight's datalink burned through even the strongest jamming signals. Periodic smoke trails indicated that the enemy was launching shoulder-fired SAMs, but his formation's laser countermeasures quickly incinerated the missiles' seekers. Having confirmed the JTAC's assessment of no civilians among the attackers, Maj Fischer systematically began to destroy the enemy force. Each aircraft carried 64 munitions suitable for targets ranging from hardened facilities, to armored vehicles, to troops in the open, and each missile cost less than the muddy pickup truck he had just destroyed, killing the adversary drone operators inside. If he somehow ran out of those weapons, he still had his aircraft's gun—and he was surgical with that.

By skillfully employing the five applications of operational agility, the Air Force of 2035 is able to hold any target at risk on or above the planet. Airmen effectively wield mission-tailored teams of systems through the air, space, and cyberspace domains to generate strategic, campaign-level and tactical effects that enable favorable conflict resolution and defend the Nation. They leverage synergistic relationships with joint forces, the Intelligence Community, and multinational partners to precisely and predictably provide the right effect, in the right amount, at the right time.

18 SEP 2035
2315Z

On The Horns of Dilemma

"Ursa Flight, Control… you are cleared to commence the attack."

Flight Leader [redacted] banked his Su-46 hard over the ocean, checking his datalink to ensure his wingman was still in trail. The coastline receded behind their formation—if their intelligence brief was correct, the American task force was just beyond the range of their sensors. His scope showed the southern formation of bombers—their escort assignment—in position and headed for the release point. Flight Leader [redacted] smirked as he thought of the bombers' long-range anti-ship missiles screaming into the USS Theodore Roosevelt, their intended target.

All at once his radios filled with a tangle of static, emergency transponders, and screaming voices from the northern formation. He watched as bomber symbols began to flash, and then disappear from his datalink. "Impossible!" sputtered [redacted] in disbelief, glaring angrily at his cutting-edge Active Electronically Scanned Array (AESA) radar and mashing his SATCOM transmit button. "Control, this is Ursa Flight… say status of northern formation… say orders!" Static filled his headset, punctuated by broken, garbled language. "Ursa… Control under cyber attack… communications… radar… lost satellite…." [redacted] strained to hear more, but the static intensified, despite his frequency-hopping radio.

Switching to the jet's inter-flight network, [redacted] again mashed the transmit button. "Ursa 2, Control is down! What do you see on your scope?" Craning to see behind him, he confirmed his wingman's presence, reassuringly tucked just under his right wing. "Ursa 2… respond!" demanded [redacted] scanning his displays to confirm a network connection. His eyes locked on his signal strength indicator, silently blinking zero to register a lost link. Gritting his teeth, [redacted]'s mind raced. "Jamming? On our most advanced and secure datalink? No problem," thought [redacted], "we've been trained for this." At that moment his AESA lit up, showing him a four-ship of inbound bogeys. "High-altitude, low-radar-cross-section… just like the tactics shop advertised," he thought. He rapidly salvoed two long-range, experimental air-to-air missiles at the lead bogeys, grinning as Ursa 2 did the same to the trail bogeys.

In just 60 seconds, all four inbound tracks had disappeared from [redacted]'s scope. With a triumphant wing-rock, he craned over his shoulder to share the excitement of the kill with his wingman. All he saw was flash of fuselage as Ursa 2 snap-rolled and dove for the deck. Then his headset exploded with crystal-clear communications on multiple nets. "Ursa Flight, Control, southern bombers are aborting. Inbound F-35s, jammers feinting from the northeast, acknowledge!" pleaded the SATCOM. [redacted]'s eyes snapped to his display, still set on 100-kilometer range, to see multiple enemy tracks already vectoring away, except for one that was nearly… "Lead, Ursa 2, BREAK RIGHT—threat, zero-six-zero, ten kilometers!" screamed the inter-flight. Flight Leader [redacted] yanked his stick right, grunting as g-forces crushed him into his seat. "How did they do that?" he snarled, pumping out countermeasures and sweating through the strain of a max-g turn. The shrieking warble of the missile lock-on warning drowned out all other sounds.

Implications

The following is an initial list of implications for force development. For the future Air Force to operate as described in this concept, today's Air Force must pursue:

- A diverse portfolio of capabilities that enable multiple combinations of air-to-space-to-cyberspace operations in all environmental conditions and in highly-contested and permissive environments.

- New concepts and capabilities to counter the increasing technology and proliferation of anti-access and area denial threats, to include multi-domain approaches and systems that can be rapidly modified when adversaries adapt their defenses.

- A modernized diverse range of munitions, emitters, and delivery systems capable of delivering scalable lethal and non-lethal options that span the range from exquisitely precise strikes to mass effects to include nuclear capabilities.

- Tailored forward presence from small, resilient bases, using dispersal, warning, active and passive defenses, rapid repair capabilities, and streamlined logistics through the use of additive manufacturing.

- Fully integrated information systems that allow aggregation of data from a variety of classified and unclassified sources, sensors, and repositories, and a degree of autonomous processing, exploitation, and dissemination.

- Removal of unnecessary classification barriers and limitations to enable information sharing in near-real time with other Services, U.S. Government agencies, allies, partners and, when prudent, private companies and individuals, to enhance the potential for national leaders' unified action. These efforts must be accompanied by fully integrated processes that safeguard sensitive material and mitigate any losses to information superiority.

- Algorithm-based (as opposed to hardware-based) human-computer interface systems that work with humans to provide predictive analysis, and assist in rapid, multi-domain course of action development by providing Big Data analytics, emulation, and testing, as well as present easily visualized information through a tailorable, user-defined operating picture.

- Integration-centric Multi-Domain Operations Centers that serve as air, space, and cyberspace headquarters containing the essential command elements with the authorities to direct multi-domain operations with a reduced manpower footprint that takes advantage of advanced data, simulation, modeling, and information technologies.

- A more transparent, networked infrastructure that integrates ubiquitous sensors, automated systems, information nodes/connections, and human cognition in a secure, reliable, resilient, and high-capacity global information architecture able to withstand breaks in connectivity while still allowing users to collaborate with other operators to maintain localized situational awareness.

- Well-developed trust relationship between leaders and Airmen that enables centralized control and decentralized execution in a dynamic future battlespace. This relationship is enhanced by leadership training with hands-on experience-based opportunities in: transformational and transactional leadership methods, tools for empowering subordinates, team-building, process-improvement, ways to foster smart risk-taking and initiative, and critical thinking.

- A balanced mix of air, space, and cyberspace capabilities composed of both sophisticated systems, platforms, and munitions for use against advanced adversaries and lower-capability systems to sustain freedom of action against a reduced or less-capable threat array. This includes manned systems, remotely operated systems, and systems with varying levels of autonomy.

- Systems and capabilities that are modular or configurable to allow rapid adaptation or upgrades, as well as interoperable with other AF and Joint systems, and a wide variety of interagency or multinational partner capabilities.

- A balanced pool of Airmen, some with deep expertise and some with diverse experience, supported by a greater and purposeful differentiation of selection, development, and placement to improve proficiency in multi-domain approaches, mission-critical areas, operational design, full-spectrum operations, and cutting-edge technologies.

- An acquisition and logistics enterprise that is capable of rapidly identifying, acquiring, and fielding solutions through organic additive manufacturing or commercial off-the-shelf sources.

- Airmen who are ready and responsive, and demonstrate general qualities such as critical thinking, adaptive behaviors, innovation, creativity, collaboration, social networking skills, emotional and cognitive intelligence, initiative, and resilience.

- Frequent training, exercises, and technology development using live, virtual, and constructive (LVC) venues to enable the conservation of resources, improve the realism of training for combat and multi-domain challenges, and facilitate the development of innovative and collaborative solutions. Leverage the commercial sector for technical and leadership-type cybersecurity training, wherever possible.

- Air Force-wide changes in Human-Systems Integration to optimize the relative and combined performance of human operators and systems through improvements in interfaces, compatibility, and adaptability that improve functionality, reduce life-cycle costs, and increase mission effectiveness across the range of Air Force missions.

- Airmen teamed with the appropriate level of automation to enhance performance in a wide range of activities to include: data processing, exploitation, and dissemination; predictive analysis and course of action development and testing; operation of individual systems and formations.

- Strong, mutually-beneficial partnerships with an array of joint, interagency, multinational, academic and commercial entities.

Conclusion

This document is about change. For too long the Air Force has, by necessity, concentrated on current operations while competitors and adversaries watched closely, analyzed its methods, and developed asymmetric ways to dissuade, impede and damage U.S. interests. The time has come to regain the initiative by placing the Air Force in an advantageous position for anticipated future contests. This document has provided a glimpse of the Air Force of 2035, and examined how Airmen will harness the power of operational agility to perform their five core missions in a dynamic, complex future against capable adversaries. The implications of this transformation will surpass those listed above. However, this transformation is neither wishful fiction nor assured fate; instead, it is a vision towards which the Air Force can strive within an operational environment that continues to shift.

There is certainly no intent to imply that an Air Force in the future can attain perfect intelligence, precision, and operational effectiveness. The nature of war, in all of its fog and friction—in its painful cost in blood and treasure—persists. It remains a human endeavor, requiring the highest of sacrifice. The Air Force will pursue this path toward operational agility as an obligation to the joint force and the Nation to try to pierce the fog, and endeavor to minimize the loss of blood and treasure in the defense of our country.

The current Air Force must design, plan and implement tangible decisions if it wishes to organize, train, equip, and provide future AF forces akin to those described in this concept. Airmen will accomplish this transformation iteratively through the strategy, planning and programming process, updating and revising their approaches and priorities as required. Along the way there will be surprises, course corrections, and emerging opportunities, but there is no time to lose: positive action is needed now. The ideas presented offer an opportunity to explore new ways to provide Global Vigilance, Global Reach, and Global Power, but they are just a starting point. Courageous action by Airmen—infused with the trust of their leadership—will realize the vision of operational agility and ensure the Air Force continues to overmatch opponents, conduct unified operations with the joint team and partners, and defend the United States from any who would seek to do it harm.

Appendix A

Strategic Master Plan Linkages

The AF Future Operating Concept offers a vision of how AF forces as a warfighting entity can use operational agility to perform their five core missions successfully in the uncertain, complex world of 2035. The Air Force Strategy, through the imperatives and vectors described in *America's Air Force: A Call to the Future*, provides the guiding policy and initial steps in this transition from the Air Force of 2015 to the Air Force of 2035. The Strategic Master Plan and its Annexes offer coherent actions to facilitate the transition. The following section links the transformational ideas described in the AF Future Operating Concept to the goals and objectives of the SMP and its Annexes to show how the Air Force will realize this vision. The 18 implications outlined in the AF Future Operating Concept are displayed in bold text below with the related SMP goals and objectives presented in corresponding sub-bullets.

- **A diverse portfolio of capabilities that enable multiple combinations of air-to-space-to-cyberspace operations in all-weather, day or night and in highly-contested and permissive environments.**
    - FH1.1. Ensure the ability to gain and maintain the required degree of control of the air to prevent effective enemy interference with friendly operations.
    - FH1.2. Ensure viable options are available to sustain capabilities provided by space assets in case they are challenged or denied, particularly for position, navigation, timing, strategic warning, and communications. This includes both resilient space systems and non-space options.
    - FH1.3. Strengthen capabilities that enable freedom of action in cyberspace, and enhance our ability to deny the same to adversaries.
- **New concepts and capabilities to counter the increasing technology and proliferation of anti-access and area denial threats, to include multi-domain approaches and systems that can be rapidly modified when adversaries adapt their defenses.**
    - FH1.4. Enhance abilities to degrade or deny situational awareness and targeting ability to an advanced enemy.
    - FH2.1. Increase emphasis on research, development, testing, and evaluation (RDT&E) for capabilities that ensure the ability to find, fix, track, target, engage and assess effects against critical target sets in highly contested environments.
    - FH2.2. Increase emphasis on stand-off capabilities that maximize speed, range, and flexibility, while maintaining the ability to transition to effective, resilient presence in the battlespace.
    - MDA.1. Orient the Air Force to a mindset that intuitively considers multi-domain options when solving complex problems, to include development of doctrine and TTPs.
- **A modernized diverse range of munitions, emitters, and delivery systems capable of delivering scalable lethal and non-lethal options that span the range from exquisitely precise strikes to mass effects to include nuclear capabilities.**

- FH2.1. Increase emphasis on RDT&E for capabilities that ensure the ability to find, fix, track, target, engage and assess effects against critical target sets in highly contested environments.

- DTR.1. Maintain a credible and robust strategic deterrence posture through sustainment, modernization, recapitalization, readiness, and protection of the Air Force's nuclear mission and supporting infrastructure.

- DTR.2. Develop, test, and implement additional non-nuclear capabilities that deter a wide range of adversaries, including non-state actors, and assure allies and partners. Consider low-cost measures that generate high-cost adversary responses.

- **Tailored forward presence from small, resilient bases, using dispersal, warning, active and passive defenses, rapid repair capabilities, and streamlined logistics through the use of additive manufacturing.**

  - FH2.7. Provide resilient installations, infrastructure, and combat support capabilities that enable the Air Force to project power rapidly, effectively, and efficiently.

- **Fully integrated information systems that allow aggregation of data from a variety of classified and unclassified sources, sensors, and repositories, and a degree of autonomous processing, exploitation, and dissemination.**

  - ISR. An adaptive, domain-neutral ISR architecture that delivers timely, tailored, decision-quality intelligence to decision makers and warfighters from the strategic to the tactical level, integrated with joint, interagency, and international partners.

  - ISR.2. Develop a robust, survivable, secure architecture to connect and integrate ISR operations across all domains, ensuring that collection and analytic systems (including non-traditional ISR platforms and sensors) and users can collaborate seamlessly.

  - ISR.4. Enhance capabilities to holistically detect, monitor, analyze, and attribute threats (kinetic or non-kinetic), adversaries, and their support networks, and improve target systems analysis to determine the best way to act on this intelligence.

- **Removal of unnecessary classification barriers and limitations to enable information sharing in near-real time with other Services, USG agencies, allies, partners and, when prudent, private companies and individuals, to enhance the potential for national leaders' unified action. These efforts must be accompanied by fully integrated processes that safeguard sensitive material and mitigate any losses to information superiority.**

  - ISR.5. Improve policies, processes, and organizations for obtaining, sharing, and releasing pertinent multi-domain intelligence with joint, interagency, and international partners.

  - MDA.2. Reappraise existing compartmentalization practices and eliminate institutional barriers to empower Airmen and organizations to employ multi-domain approaches.

- **Algorithm-based (as opposed to hardware-based) human-computer interface systems that work with humans to provide predictive analysis, and assist in rapid,**

multi-domain course of action development by providing Big Data analytics, emulation, and testing, as well as present easily visualized information through a tailorable, user-defined operating picture.

  - ISR.4. Enhance capabilities to holistically detect, monitor, analyze, and attribute threats (kinetic or non-kinetic), adversaries, and their support networks, and improve target systems analysis to determine the best way to act on this intelligence.

- **Integration-centric Multi-Domain Operations Centers that serve as air, space, and cyberspace headquarters containing the essential command elements with the authorities to direct multi-domain operations with a reduced manpower footprint that takes advantage of advanced data, simulation, modeling, and communication technologies.**

  - MDA. The Air Force possesses a multi-domain mindset and suitable processes that maximize agility and provide a wide range of options to perform the Service's five core missions.

  - MDA.1. Orient the Air Force to a mindset that intuitively considers multi-domain options when solving complex problems, to include development of doctrine and TTPs.

  - AG3. Flatter, collaborative, agile organizations with energetic vertical and horizontal feedback loops.

  - AG3.2. Rigorously reevaluate and adjust Air Force organizational structures to address a dynamic security environment.

  - IN2.3. Orient and educate the force to the idea that a blend of varied perspectives, cognitive approaches, and critical thought is a vital combat capability and integrate it into all aspects of our operations. Focus on eliminating institutional barriers to creating and retaining a diverse team.

  - FH2.3. Improve Air Force command and control doctrine and implementation through study, wargaming, and exercises to validate best practices that embrace variable models of centralization/decentralization, organization, and execution.

- **A more transparent, networked infrastructure that integrates ubiquitous sensors, automated systems, information nodes/connections, and human cognition in a secure, reliable, resilient, and high-capacity global information architecture able to withstand breaks in connectivity while still allowing users to collaborate with other operators to maintain localized situational awareness.**

  - ISR.2. Develop a robust, survivable, secure architecture to connect and integrate ISR operations across all domains, ensuring that collection and analytic systems (including non-traditional ISR platforms and sensors) and users can collaborate seamlessly.

- **Well-developed trust relationship between leaders and Airmen that enables centralized control and decentralized execution in a dynamic future battlespace. This relationship is enhanced by leadership training with hands-on experience-based opportunities in: transformational and transactional leadership methods, tools for**

empowering subordinates, team-building, process-improvement, ways to foster smart risk-taking and initiative, and critical thinking.

- AG1.3. Ensure institutional processes and culture value individual initiative, support productive failure in pursuit of innovation, provide latitude to experiment, and instill a cost-conscious mindset in all Airmen.

- AG1.4. Combine training across multiple mission sets, including integrated LVC venues and operator-in-the-loop Modeling & Simulation (M&S), to cultivate Airmen trained in agile and robust decision-making who can devise multi-domain solutions to complex problems in uncertain, contested environments.

- AG3.3. Educate, train, and empower Airmen to implement agile, tailored approaches to organization and accountability, to modify counterproductive practices, and to improve lateral and vertical collaboration.

- **A balanced mix of air, space, and cyberspace capabilities composed of both sophisticated systems, platforms, and munitions for use against advanced adversaries and lower-capability systems to sustain freedom of action against a reduced or less-capable threat array. This includes manned systems, remotely operated systems, and systems with varying levels of autonomy.**

  - ISR.1. Rebalance resilient ISR sensors, systems, and processes toward operations in high-end contested environments, and focus on moderately priced systems, to include commercial technology, for permissive environments.

  - FH2.2. Increase emphasis on stand-off capabilities that maximize speed, range, and flexibility, while maintaining the ability to transition to effective, resilient presence in the battlespace.

- **Systems and capabilities that are modular or configurable to allow rapid adaptation or upgrades, as well as interoperable with other AF and Joint systems, and a wide variety of interagency or multinational partner capabilities.**

  - AG2.1. Ensure systems are designed, engineered, tested, acquired, and sustained smartly, efficiently, and cost-effectively. As integrator, the Air Force will define technical baselines and common architectures and ensure modularity and responsiveness to Airmen's needs in a dynamic strategic environment.

  - FH2.4. Improve flexibility, commonality, and interoperability of our C2 and communications to integrate air, space, and cyberspace effects delivered by different Services or agencies.

- **An acquisition and logistics enterprise that is capable of rapidly identifying, acquiring, and fielding solutions through organic additive manufacturing or commercial off-the-shelf sources.**

  - AG2.1. Ensure systems are designed, engineered, tested, acquired, and sustained smartly, efficiently, and cost-effectively. As integrator, the Air Force will define technical baselines and common architectures and ensure modularity and responsiveness to Airmen's needs in a dynamic strategic environment.

- AG2.3. Develop an "agile acquisition" mindset that challenges bureaucratic inertia, streamlines processes, implements continuous improvement, and reduces risk through prototyping and new engineering development models.

- **A balanced pool of Airmen, some with deep expertise and some with diverse experience, supported by a greater and purposeful differentiation of selection, development, and placement to improve proficiency in multi-domain approaches, mission-critical areas, operational design, full-spectrum operations, and cutting-edge technologies.**

  - AG1.2. Implement an individually tailored, generationally appropriate, cutting-edge, life-long approach to education and training.

  - AG1.5. Preserve full-spectrum warfighting, expeditionary, and combat support capabilities by retaining expert Airmen with experience in recent conflicts, codifying lessons learned, and further integrating joint training (including LVC) to offset reduced resourcing for low-intensity operations.

  - AG1.6. Modernize Airman management mechanisms to ensure they value and provide increased opportunities for broad and varied professional experience; enable the continuum of service; improve Commander- and Airman-level professional development; and provide career-long, proactive retention measures beyond financial incentives.

  - AG2.2. Improve acquisition tradecraft and business acumen by actively managing people with the appropriate education, training, and skills; and increasing efficiency and effectiveness in acquisition tools and techniques (including disciplines like systems engineering and digital thread tools).

- **Airmen who are ready and responsive, and demonstrate general qualities such as critical thinking, adaptive behaviors, innovation, creativity, collaboration, social networking skills, emotional and cognitive intelligence, initiative, and resilience.**

  - AG1.1. Recruit/assess individuals with demonstrated potential for critical thinking, adaptive behavior, character, initiative, innovation, and contemporary mission-critical skills.

  - AG1.3. Ensure institutional processes and culture value individual initiative, support productive failure in pursuit of innovation, provide latitude to experiment, and instill a cost-conscious mindset in all Airmen.

  - GCT.1. Increase the technical acumen of all Airmen to enable greater innovation and experimentation.

- **Frequent training, exercises, and technology development using LVC venues to enable the conservation of resources, improve the realism of training for combat and multi-domain challenges, and facilitate the development of innovative and collaborative solutions.**

  - AG1.4. Combine training across multiple mission sets, including integrated LVC venues and operator-in-the-loop M&S, to cultivate Airmen trained in agile and robust decision-making who can devise multi-domain solutions to complex problems in uncertain,

contested environments.

- **Air Force-wide changes in HSI to optimize the relative and combined performance of human operators and systems through improvements in interfaces, compatibility, and adaptability that improve functionality, reduce life-cycle costs, and increase mission effectiveness across the range of Air Force missions.**

    - FH2.6. Improve execution speed and situational understanding through advances in human-machine teaming, automated PED, analysis, and updated C2 and communication capabilities.

- **Airmen teamed with the appropriate level of automation to enhance performance in a wide range of activities to include: data processing, exploitation, and dissemination; predictive analysis and course of action development and testing; operation of individual systems and formations; and a variety of manual tasks.**

    - FH2.6. Improve execution speed and situational understanding through advances in human-machine teaming, automated PED, analysis, and updated C2 and communication capabilities.

- **Strong, mutually-beneficial partnerships with an array of joint, interagency, multinational, academic and commercial entities**.

    - IN3.2. Capitalize on the variety of perspectives and expertise resident within think tanks, academia and industry to enrich our understanding of threats and opportunities.

    - IN3.3. Deepen our relationships with the joint team, Intelligence Community, diplomatic institutions, developmental agencies, local governments, businesses, communities, and international partners through sustained dialogue, increased training and exchange, aviation security cooperation, and iterative enterprises to codify shared doctrine, tactics, and capabilities.

Appendix B

Glossary

A2/A	Anti-Access/Area Denial
ABI	Activity-Based Intelligence
AESA	Active Electronic Scanning Array
AF	Air Force
AFFOC	AF Future Operating Concept
AFSEA	Air Force Strategic Environment Assessment
AOC	Air Operations Center
AOR	Area of Responsibility
ASAT	Anti-Satellite
ATO	Air Tasking Order
BMC3	Battle Management Command, Control and Communication
C2	Command and Control
C4ISR	Command, Control, Communications, Computer, Intelligence, Surveillance, and Reconnaissance
CAS	Close Air Support
COA	Course of Action
CONOPS	Concept of Operations
CONUS	Continental United States
COP	Common Operating Picture
CR	Contingency Response
DI2E	Defense Intelligence Information Enterprise
DoD	Department of Defense
DoDD	Department of Defense Directive
E-JPADS	Enhanced Joint Precision Aerial Delivery System
FAC	Forward Air Controller
FVEY	Australia, Canada, Great Britain, New Zealand, and United States
GBL	Ground-Based Laser
GIISR	Global Integrated Intelligence, Surveillance, and Reconnaissance
GPS	Global Positioning System
GPS	Global Precision Strike
HAF	Headquarters Air Force
HARM	High-speed Anti-Radiation Missile
HSI	Human-System Integration
IADS	Integrated Air Defense System
ICBM	Inter-Continental Ballistic Missile
ICITE	Intelligence Community Information Technology Enterprise
IO	Information Operations
ISR	Intelligence, Surveillance, and Reconnaissance
JTAC	Joint Terminal Attack Controller

JFC	Joint Force Commander
JIE	Joint Information Environment
JP	Joint Publication
JSOTF	Joint Special Operations Task Force
JTAC	Joint Terminal Attack Controller
LEO	Low Earth Orbit
LOC	Lines of Communication
LVC	Live, Virtual, and Constructive
MAJCOM	Air Force Major Command
MDC2	Multi-Domain Command and Control
MDOC	Multi-Domain Operations Center
MHE	Materials Handling Equipment
MMLR	Multi-Mission Long-Range
MOG	Maximum-on-Ground
MRE	Meal Ready-to-Eat
M&S	Modeling & Simulation
NATO	North Atlantic Treaty Organization
NC3	Nuclear Command and Control Communications
NGO	Non-Governmental Organization
OBP	Object-Based (Intelligence) Production
OODA	Observe, Orient, Decide, Act
PED	Processing, Exploitation, and Dissemination
PNT	Positioning, Navigation, and Timing
RAIM	Receiver Autonomous Integrity Monitoring
RDT&E	Research, Development, Testing, and Evaluation
RFID	Radio Frequency Identification Device
RGM	Rapid Global Mobility
RTB	Return to Base
SAM	Surface-to-Air Missile
SATCOM	Satellite Communication
SDA	Space Domain Awareness
SF	Security Forces
SMP	Strategic Master Plan
SP3	Strategy, Planning, and Programming Process
SSA	Space Situational Awareness
SSN	Space Sensor Network
TTP	Tactics, Techniques, and Procedures
UAS	Uninhabited Aircraft System (formerly unmanned aircraft system)
UDOP	User-Defined Operating Picture
USG	U.S. Government

Operational agility. The ability to rapidly generate—and shift among—multiple solutions for a given challenge. **Provides the approach and is the unifying principle that guides how the Air Force conducts its core missions in the future.**

Integrated Multi-Domain Operations. Full interoperability among air, space, and cyberspace capabilities so that the combined effect is greater than the sum of the contributed parts without being limited by rigid interdependence.

Superior Decision Speed. The ability to make accurate decisions at a rate that provides advantages over adversaries. Collected data will be integrated in an open, adaptive information construct unburdened by unnecessary classification barriers. Air, space, and cyberspace ISR assets will share information seamlessly and contribute to a global Common Operating Picture (COP).

Dynamic Command and Control. Enhanced battlespace awareness, improved planning and assessment, and organizational flexibility to enable elements to self-synchronize and adapt to fulfill commander's intent. Commanders, planners, and operators will have the requisite authorities, at the appropriate levels, to integrate effects.

Balanced Capabilities Mix. An Air Force that applies a balanced mix of air, space, and cyber forces across domains with an array of partners. The Air Force will use an appropriate subset of its capabilities—suited to the situation, mission and threat—and adapt as required.

Performance-Optimized Teams. Evolution in the way the service achieves readiness and required performance levels will change the organization, training and equipping of Airmen. As a result of the Air Force's prioritized focus on critical thinking, adaptive behavior, innovation, and collaboration skills, Airmen will be more agile and effective in the battlespace. Agile Airmen with critical thinking, adaptive behavior, innovation, and collaboration skills team with advanced technology, including Human-System Integration (HSI). Proper HSI empowers humans to excel in tasks that they can do better than machines, while automated systems accomplish the tasks that they can do better than humans.